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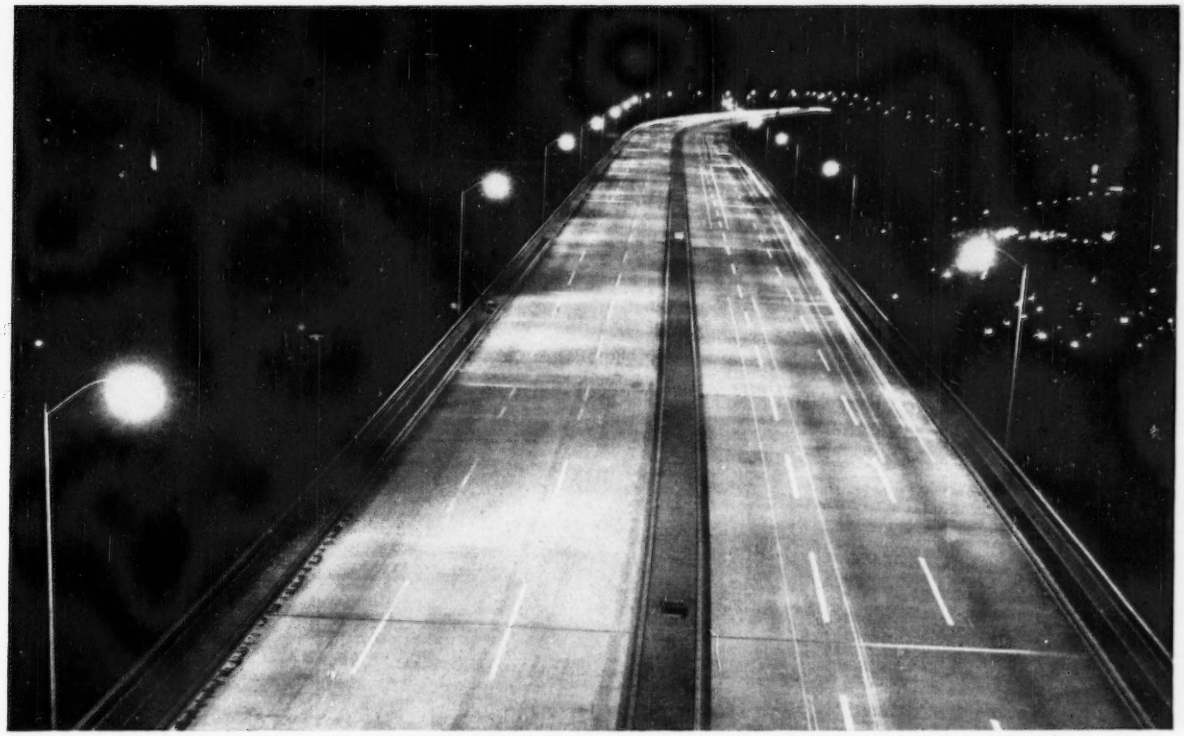

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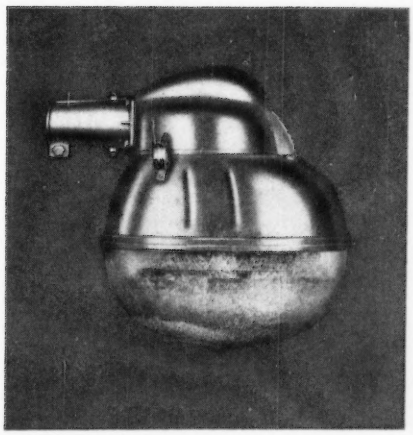

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Traffic Engineering

OFFICIAL PUBLICATION OF THE INSTITUTE OF TRAFFIC ENGINEERS

VOLUME XXIII | JANUARY, 1953 | NUMBER 4

COVER: This is a winter aerial view of New Haven, Connecticut, home of ITE Headquarters, showing part of the business center (right half), the center "Green" (practically all New England cities and towns have "greens"—in some places they are called "commons") and part of Yale University (lower ¾ of left half). The harbor is a half mile to the right, out of camera range. The green is bisected by a one-way street for traffic moving south, from left to right, past the three churches. Its northbound mate borders far side of the green, passing telephone building (tall white building upper center). University "Old Campus" is the block with large inner court in lower center where is located the oldest remaining original Yale building (small oblong building with snow on roof in inner court) where Nathan Hale roomed when an undergraduate 1770-73. Strathcona Hall where ITE Headquarters is located on the second floor—Yale Bureau of Highway Traffic on third floor—is white building with tower shown slightly above center extreme left immediately beyond Woolsey Memorial Hall (right angled structure with dome at apex) across street from cemetery (small open triangular area).

Traffic Engineering is that phase of engineering which deals with the planning and geometric design of streets, highways, and abutting lands, and with traffic operation thereon, as their use is related to the safe, convenient, and economic transportation of persons and goods.

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May We Offer . . .

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Frankly Speaking

THE FOLLOWING QUOTATION from the 1952 Beecroft Memorial Lecture authored and delivered by Franklin M. Kreml, Director of the Traffic Institute, Northwestern University, and Traffic Division, International Association of Chiefs of Police, should be of vital interest to every city engineer as well as every traffic engineer or any city official directly responsible for engineering problems relating to traffic operation and control.

"But traffic law enforcement is not self-sufficient. It depends to a considerable degree, upon education and engineering. Education and engineering have an important effect upon the quantity and quality of traffic law enforcement which may be required to secure street and highway safety."

"Traffic engineering makes compliance on the part of the driver and pedestrian easier and broadens the latitude of action for the driver and pedestrian without increased hazard. Less enforcement is required, therefore, and at the same time, such enforcement as is required is made easier to administer."

An analysis of these comments points out that the engineer has an important responsibility. However, all engineers must have similar attitudes that traffic engineering also is not self-sufficient. Any traffic engineering official with the slightest thought that he can work independently to accomplish effective and efficient traffic control and the reduction of accidents has been working under a tremendous handicap.

The accomplishments can only be achieved through operational coordination between engineering, enforcement and education — each equally important. This theory based on years of experience and proven without question should be applied to our smaller communities. Yet, in this category the problem goes a little deeper. City engineers in many instances have failed to assume the responsibilities of traffic engineering operation and planning. It is often said that police administrators have been forced to take over the traffic engineering duties because weak engineering programs or no programs at all offsets the effects of good enforcement activities.

How can the Institute of Traffic Engineers stimulate interest among city engineers in the smaller communities in the importance and advantages of directing traffic engineering activities? How can the Institute stimulate improved traffic engineering programs in these cities?

We have at least three mediums which can play an important part in stimulating more effective traffic engineering programs.

1. Local chapters invite engineers of small communities to become chapter affiliates. Later they might qualify for national membership.

2. Promote broader use and distribution of the technical notebook, handbook and magazine.

3. Co-sponsor more state engineering conferences through chapter participation, similar to the recent successful meeting at Columbia, Missouri and attended by more than one hundred Mayors, City Managers, Police Chiefs and City Engineers of small communities.

This challenge must be accepted because it is appropriate for the Institute to provide the real guidance so urgently needed.

Vice-President

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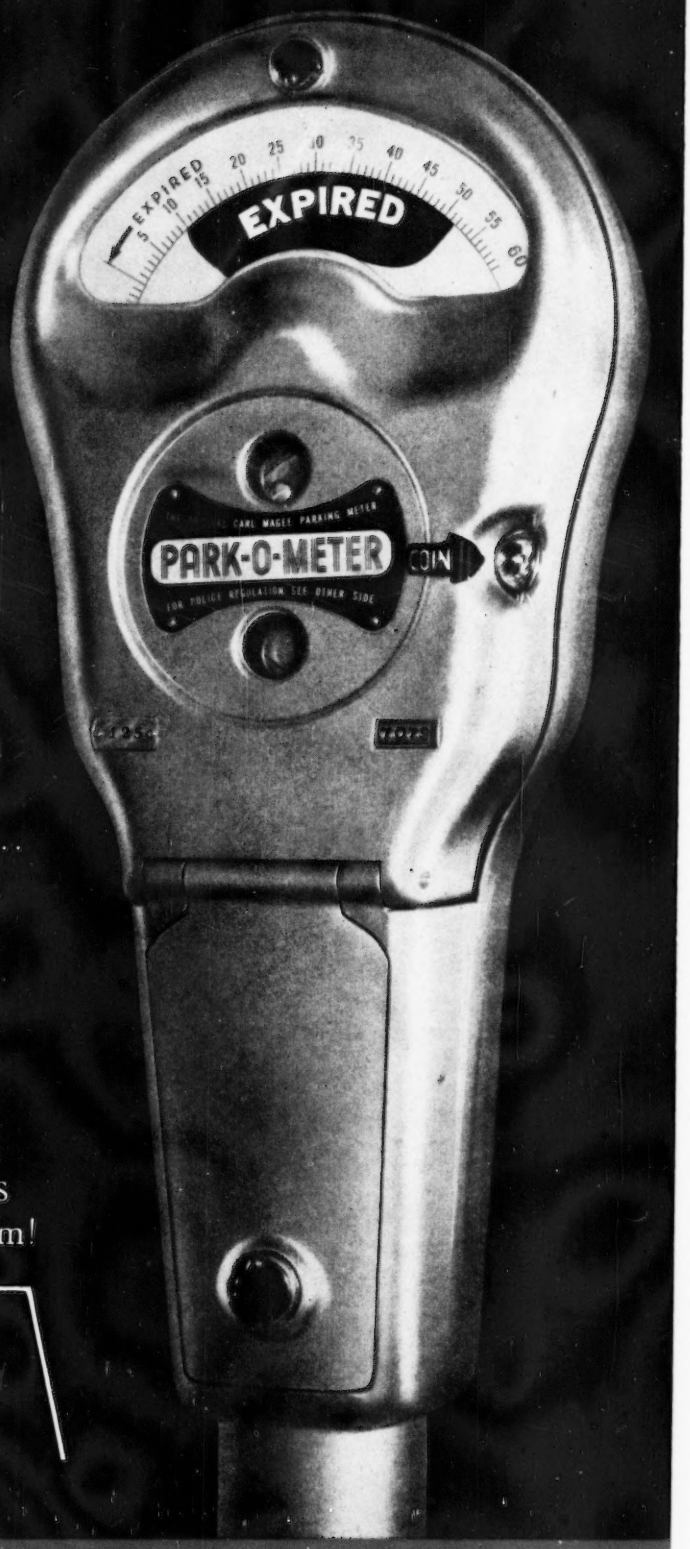

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23rd Annual ITE Meeting Papers

Nos. 5 through 13, presented at the Opening General Session as panel discussion on subject "Higher Standards in Traffic Engineering", September 9, 1952, at 10:00 a.m.

At the 1951 Annual Meeting a resolution was passed calling for the preparation of a statement defining the science of Traffic Engineering and the work of Traffic Engineers. During the 1952 meeting the Technical Division's Committee 2C—Philosophy & Principles of Traffic Engineering—Lloyd F. Rader, Chairman—presented a series of papers as a panel discussion, which so ably define and demonstrate many of the present day phases of the science that this month's magazine is being devoted to bringing you all nine papers in order that this important discussion will appear simultaneously.

(No. 5) Higher Standards in Traffic Engineering

By Lloyd F. Rader (Mem. ITE)

Professor of Civil Engineering, University of Wisconsin, Madison, Wisconsin

TRAFFIC engineering is very young as a distinct professional field. In the early stages of development of any science, an indefinite state of the subject is a natural condition. What is encouraging is the appreciation on the part of leaders in the traffic engineering field that there is need of progress towards the development of a solid scientific foundation for traffic engineering.[1#] Such scientific principles should serve as a framework for traffic engineering and should enable traffic engineers to achieve higher standards.

The development of a scientific framework will make possible better service by traffic engineers to the public. It will also afford better recognition to traffic engineering as a distinct profession.[1]

The chief attributes of a scientific discipline are:[2]

I. Scope

II. Method of analysis

III. A body of "received doctrine" or basic set of laws or principles accepted as true by teachers of the subject and practitioners in the field.

I Scope

If traffic engineering is to be recognized as a separate branch of engineering with a distinct discipline, its scope must be established. To me, the word "scope" implies "fencing in" some area which is distinct. The building of a fence also "fences out" other types of work and other approaches to the problems. Traffic engineers must be willing to define the scope of their function in order to establish professional standing. The "fencing out" in turn means that traffic engineers recognize that other fields are different and that the traffic engineer does not consider his field of specialized knowledge so extensive as to invade the proper spheres of other types of work. For example, it should be recognized that the traffic engineer is not trained to handle all phases of city planning nor of traffic enforcement by police personnel. Nor is the traffic engineer concerned with all aspects of the highway transportation field.

I can remember discussing in 1930 with a group of traffic engineers what the role and scope should be for the Institute of Traffic Engineers which was then being organized. The founders of the Institute did not want to cover the whole field of highway transportation but wished to confine the scope to traffic engineering. This was a wise decision to establish a scope for the Institute of Traffic Engineers and this idea of maintaining a scope should be given attention in plans for development of the traffic engineering profession.

II Method of Analysis

The method of analysis in science consists of three steps (A) Making of observations and collection of facts, (B) Logical analysis of the data and formulation of theories to explain the facts, and (C) Experimental testing of the theories.

(A) *Facts.* Engineers are trained to obtain facts upon which to base their decisions and formulate their plans of action. This is one of the main distinguishing features of a traffic engineer as compared to a layman, namely that the traffic engineer bases his actions on facts and if he doesn't have the facts he goes out and gets them. We are all aware of the great interest of the general public in traffic, but a great deal of the discussion about traffic is based on opinion and not facts. The making of traffic surveys to obtain facts is one of the important functions of traffic engineers.

But, in stating that traffic engineers collect facts upon which to base action, it is important to point out that the collection of facts alone is not enough. Analysis of collected facts is necessary to develop methods and establish principles. Pertinent to this is Poincare's statement "Science is built of facts, as a house is built of stones; but an accumulation of facts is no more a science than a heap of stones is a house."

(B) *Logical Analysis of the Data and Formulation of Theories.* The facts of observation must be interpreted, coordinated, and compared. Engineers are trained to analyze the data presented about a given problem and to solve the problem. In general, such solutions are practical. It is be-

Numbers refer to reference at end of report. (Page 136)

The Committee on Philosophy and Principles of Traffic Engineering submits its report. Left to Right, Edmund R. Ricker, Martin E. Bruening, Taylor D. Lewis, Chairman Lloyd R. Rader, Theodore W. Forbes. President F. B. Crandall, extreme right, presided. Messrs. B. D. Greenshields, H. H. Hemmings, C. C. Wiley and R. Winfrey the other members of the Committee were not present when picture was made.

lieved that traffic engineers should give more attention to the utilization of mathematics and the methods of the natural scientist in analyzing traffic data and obtaining solutions.

In this connection, it is desired to refer to the field of "operational research" or "operations research" which was developed for military operations during World War II[3&4] and which is now being adapted to civilian use in industry. A paper by H. C. Levinson and A. A. Brown[5] points out ways of applying operational research to traffic operating problems. This method considers means of improving operations rather than means of improving traffic flow by designing new equipment. Operational research consists of three steps by analogy with scientific research as follows: (1) A search for the revelant facts, (2) Analysis of the facts by methods of mathematics and the natural sciences and elaboration of theories to explain the facts, and (3) The facts and theories are used to make predictions about future operations. The objective of operational research is not to collect a great deal of data but rather to understand, and through understanding to improve the operations.

A study of the marking of pedestrian crossings which might be termed an example of operational research has been reported by Dr. W. H. Glanville, Director of Road Research in Great Britain.[6] This study covered one thousand pedestrian crossings, five hundred with ordinary markings and five hundred with wide white and black alternating stripes longitudinal with the roadway, called "zebra" stripes. The study of pedestrian and driver behavior at both types of crossings was made before and during a Pedestrian Propaganda Week. In such a study there are manifold influences to be explored, yet only certain influences are found to be dominant and many features, from a practical standpoint, can be disregarded.

In carrying out such studies, the use of the mathematics of statistics and the mathematical theory of probability has great potentialities. In this connection I should like to refer to the thesis by Mr. John P. Kinzer[7] entitled "Application of the Theory of Probability to Problems of Highway Traffic" which was completed in 1933 under the direction of Lloyd F. Rader. A digest of this thesis was published in the 1934 Proceedings of the Institute of Traffic Engineers. This thesis represents an early attempt in the United States of applying the mathematical theory of probability to problems of traffic flow. Data from early speed studies in Connecticut were used. Mr. Kinzer compared his results on probability of no interference on a two-lane highway with the results of the traffic study conducted by Dean A. N. Johnson on the Washington-Baltimore highway.

It is also desired to refer to the work of Greenshields, Schapiro, and Ericksen on "Traffic Performance at Urban Street Intersections" where a unique photographic method and application of principles of mechanics and the mathematical theory of probability were employed. These investigators state in their summary: "The traffic problem treatments by probability theory and other principles developed in this monograph are only explanatory of a variety of applications. The tentative constants of traffic performance deserve further checking and others need development. Results of this preliminary exploration are distinctly encouraging and it is hoped they will stimulate further work along this line."

(C) *Experimental Testing of the Theories.* This part of the process of analysis must be carried out by various investigators under controlled conditions to verify or disprove the theories which have been formulated. This is a wide open field in traffic engineering and is one to which every traffic engineer in practice should give attention. It should be remembered that the proof of the pudding is in the eating.

III Body of "Received Doctrine" or Basic Set of Principles

Now we come to the third attribute of a scientific discipline, which is the body of "received doctrine" or basic set of principles accepted as true. Traffic engineering needs a "distilling" of a myriad number of facts and methods which have been developed, into a body of received doctrine or basic set of laws. Manifestly, in view of the wide range of subjects involved in traffic engineering even inside the fences

of the scope of the field, no theorem or law can be established which will solve all the problems of traffic engineering. That is to say that we can not expect to have a law for traffic engineering analogous to Hooke's law that stress is proportional to strain which is a fundamental law of structural engineering. Nor by analogy a Bernoulli theorem as for hydraulic engineering. But it is believed that a basic set of principles and procedures can be formulated for important phases of traffic engineering work which will promote the development of traffic engineering.

Chemical engineering, which might be called process engineering, is probably the branch of engineering based more on scientific principles than on art, of any of the branches of engineering.[8] It is a relatively new branch and is conceived on the idea of applying given principles about manufacturing operations such as distillation, evaporation, filtration, and heat transfer (called unit operations) for all chemical and physical processes rather than to study each industrial process individually in detail. A similar approach to the different problems encountered in traffic engineering might be attempted. For example, all traffic movements might be analyzed from the standpoint of the law of motion (kinematics and kinetics.) Or all highway designs might be analyzed on the basis of geometrics. Also problems in traffic capacity might be analyzed on the basis of probability of no interference.

Analogies may be helpful in establishing scientific principles. The intersections of the several domains of learning are the common grounds on which experience is correlated and knowledge coordinated.[10] For example, the analogy of the flow of traffic to fluid flow in a pipe system has been suggested.[5]

Another step in establishing scientific principles is the making of inferences.[10] Inferences may be helpful in formulations of hypotheses but must be checked by experiment and observation.

Finally, principles established should be helpful not only in explaining events or actions of the past, but also in forecasting occurrence of phenomena for the future. For example, principles of traffic flow should make it possible to predict situations and suggest solutions of problems of the future.

Many results of scientific research can be expressed by means of mathematical expressions. The methodology of mathematics is deductive, beginning with definitions and postulates and proceeding logically to a theorem.[10] It must always be kept in mind, however, that if the suppositions made initially are wrong that the deduction will be wrong, regardless of how complicated the mathematical process may be. The traffic engineer should become more familiar with mathematical tools; the theory of probability is an effective tool which the traffic engineer should cultivate.

Art Versus Engineering Science

Some will wonder why the art of traffic engineering has not been mentioned before. There is, of course, an art as well as a science of engineering. All branches of engineering were based originally on art and then increasingly on science as engineering science developed. Each branch of engineering developed because there was a need for it; engineering was not originated and a need for it then developed but the other way around. This was true of traffic engineering. Engineers and technical men made possible the automotive vehicles and the highways; the use of the motor vehicle on the streets and highways became so widespread that the need for traffic engineering arose. Traffic engineering has developed both as an art and science. Recommendations for actual policy have often been made on an ad hoc basis rather than by applying a set of principles. More emphasis should be placed on the development of traffic engineering as an engineering science and less as an art as progress is achieved.

Criteria For Objectives

In establishing a framework of scientific principles, there must be agreement on a set of concrete and measurable objectives. The objectives chosen must meet the following criteria:[2]

(1) The objectives should be non-controversial in nature,

(2) The objectives should be reduced to measurable quantities so as to provide an empirical test of the extent to which particular operations bring actual conditions closer to desired conditions, and

(3) The list of objectives should be complete so that no major objective of traffic engineering will be omitted.

Concerning criterion (1), it may be controversial in traffic engineering practice as to the relative importance of the *flow of traffic* as compared to *safety*.

Outline of Traffic Engineering Fields

A brief outline of the fields in traffic engineering is given.

Traffic Engineering

I. Division of Physical Science
   - A. Design of physical facilities.
     Example. Planning and design of highways, geometrics, channelization, capacity, and mechanics.
   - B. Equipment
     Example. Signals, lighting, gadgets.
   - C. Devices
     Example. Signs and markings.
   - D. Operations
     Example. Control of traffic by varying operational procedure using existing equipment and facilities as for example changing cycle times of signals.

II. Division of Social and Biological Sciences
   - A. Human factors
     Example. Drivers and pedestrians—attitudes, obedience to regulations, efficiency, reaction times.
   - B. Public Relations
     Example. Education of public in safety practices.
   - C. Economics
     Example. Comparison of equipment and devices
   - D. Administration
     Example. Administration of Traffic Engineering Department in a State Highway Department, or Traffic Engineering Department in a city.

No attempt will be made to discuss all aspects of the subjects, but the different members of the committees have discussed just a few in perhaps a different way. These discussions are attached to this report.

Long-Range Versus Short-Range Aspects

The problems of traffic engineering involve long-range as well as short-range aspects. Long-range improvements involve planning of highways and streets for regions and cities, new layouts, and new equipment. However, great improvements can be made by making better use of existing facilities.

Highway Planning

A traffic engineer should be a planner if he is to function as he should. We should encourage more engineers to study planning but the traffic engineer must be a planner and a

student of planning if he is to go very far in solving the problems of highway traffic. It has long been realized that highway traffic problems do not pertain merely to the highway itself but to the city or region surrounding the highway which the highway serves. The traffic engineer must be a student of the development of the city or region if he is to handle the problems of traffic on the highway. In this connection, one making a master plan for the development of a city becomes aware of the futility of many stop-gap temporary expedients which are proposed as palliatives for the traffic problem. The traffic engineer must not only be able to conceive and install arrangements and systems to utilize existing highway facilities for expediting the flow of traffic, but he must be concerned with the "long-range" problems of providing master plans and adequate highway facilities to handle the traffic of the future.

The action of the City of Detroit in establishing a Department of Streets and Traffic which is responsible for planning and design of highway facilities as well as traffic operations is a notable one.[11] It provides coordinated control over highway planning, design, and traffic operations, and places that control and responsibility in the hands of traffic and highway engineers. It is a model for other cities. (An improvement would be to include also street construction and maintenance in the Department of Streets and Traffic according to Mr. D. Grant Mickle.) Planning is an important part of the work in this organization plan.

Traffic engineers should study city planning, particularly those phases such as street pattern, transportation, transit, and land subdivision which have a relationship to highway planning. The phase referred to as "Minimum Travel Distance"[2] which pertains to planning of residential districts in relation to places of employment and business, should be given special attention by traffic engineers. This involves the proper location of industrial centers and business districts with respect to residential areas to simplify traffic movements. It also has to do with the planning of space for our cities. The automobile makes possible the utilization of space as is evidenced by the spreading out of our cities and the development of suburbs, but the motor vehicle also causes congestion where space requirements have not been adequately planned. There will be overcrowding of vehicles as long as there is excessive concentration of business in certain areas and inadequate planning to reduce this concentration and obtain better circulation of traffic. The traffic engineer as a planner of streets and highways should endeavor to make improvements in traffic conditions by long-range planning.

There may be criticisms that the traffic engineer is extending the scope of traffic engineering too far by assuming responsibility for planning of streets and highways, but the author feels that it is necessary to coordinate highway planning and design with traffic operations if desired results are to be obtained.

Achievements of Traffic Engineering

Dean Arthur B. Gallion in his book, "The Urban Pattern" makes this comment about traffic control devices in Chapter 23, "The Circulation System" in section entitled, "Negative Control — Traffic Engineer"; *"The devices* are more appropriately described as stunts, rather than solutions; they are expedient measures to cope with immediate traffic problems in the form of "first-aid" treatment and *offer no real improvement in the capacity of the transportation system to move people."* (Italics by Rader.)

Mr. Vernon T. Kupel in Traffic Engineering, June 1952, pp. 336-337 has contributed a reply to the statement by Dean Gallion. Mr. Kupel states: "There are facts to prove that, with a large volume of traffic, signals do not lessen the volume handled at a given intersection but, under described conditions, would tend to increase the volume that the intersection could handle.

"Even in the case of a new highway, some control will be necessary. The traveling public will have to be told how to use the highway or a multiple level grade separation, if it is to be used properly. Therefore, lane lines, signs, signal lights and various means of giving information must be used so that the motorist will know what to do.

"As long as there are vehicles on our highways, there will have to be some sort of mass control and as time passes, I believe the prestige of the Traffic Engineers who plan these controls will increase."

Education of the Traffic Engineer

Educators should emphasize fundamental principles of science (particularly physics and mechanics) and mathematical methods and spend less time on reading or descriptive courses. This is not an easy matter to achieve for most undergraduate students, considering the limited time available in the average four year curriculum and considering that the students want to get a speaking acquaintance with the practice of the field of specialization.

For graduate students in traffic engineering, however, mechanics covering the laws of motion (kinetics and dynamics) and mathematics such as theory of probability and statistical methods should be required; and emphasis placed on research—collecting and analyzing data from the field and correlating that data—in other words the procedure fundamentally of the natural scientist. I should like to emphasize the thesis in this regard as being a suitable instrument for the student to gain experience in research in traffic engineering.

Some will say that the objective in graduate study is "specialization." Such specialization may be achieved by the providing of advanced instruction and the opportunity for research. But one who does not go deeper into the matter than to say that specialization is the aim of graduate study, misses the true spirit and purpose of graduate study. The *real* objective is to lead the student to a more profound and thorough understanding of basic, scientific principles and to aid him in developing a mastery of principles and of methods of attack that will make it possible for him to enter into new fields with greater assurance and competence.

Function of Institute of Traffic Engineers In Developing Principles

Although there is a wealth of information in the literature on traffic engineering, the principles developed and applied by many traffic engineers have not been published. The older men should write up the practices they have established so that these will be available for the younger men of the profession. A procedure of correlating and organizing such information into a framework of scientific principles should be a continuing activity of the Institute of Traffic Engineers.

In closing, let me say that Mr. Lenox R. Lohr, President of the Centennial of Engineering has made this suggestion: "Each paper should include a brief review of the past, present the latest thoughts on the subject, and give a glimpse into the future." Our leaders in the Institute of Traffic Engineers are interested in developing a framework of scientific principles on which traffic engineering can be developed to render even greater service in the future.

(References shown on page 136)

23rd Meeting Paper No. 6
Part of Committee Report

The Nature of Traffic Engineering

By Bruce D. Greenshields (Mem. ITE)

Professor & Executive Officer, Civil Engineering Department,
George Washington University, Washington, D. C.

IN DISCUSSING the nature of traffic engineering, it must be kept in mind that while its basic philosophy is common to all engineering, it is distinctly different from other branches of engineering. This difference is brought into relief if we first define engineering in general and then point to the features of traffic engineering that set it apart.

Over one hundred years ago, Thomas Tredgold defined engineering as, "The art of directing the great forces of power in nature for the use and convenience of man." This is still an unexcelled definition. Engineering is thus defined as an art based upon science. Science is the accumulated and systematized knowledge that the engineer uses to serve mankind.

Pure science is not concerned with either "use or convenience". It is concerned with the accumulation and organization of facts and the development of general laws relating to these facts. Science seeks fundamental truth, and scientific methods are designed to lead to unquestionable results.

The engineer masters the sciences of physics, chemistry and mathematics in order that he may use them. But the mastery of these is not sufficient. As he works to serve man, the engineer is confronted with a vast number of problems having to do with human relations and with man's reaction to his environment. These are not in the realm of the physical sciences but of psychology, economics and sociology.

In response to man's desire to cross a river or a bay, the engineer designs and builds a bridge so graceful, beautiful and far-flung that it is pronounced one of the wonders of the modern world. What the layman does not know is that the works of the engineer constantly involve problems of law, sociology and economics and that the decision in regard to these is often more difficult than the problems of engineering design.

The engineer's ability to turn to practical account the discoveries of science is the basis of civilization with all its achievements and also its faults. In order to expedite the application of science, the engineer has developed certain methods of doing things. These methods are described as being the "engineering approach". But the engineer must never let this seeking for "streamlined efficiency" lead him into paths of rigidity. The techniques of the engineer should be used to free his mind from details and leave time for creative thinking and originality. These also are part of the engineering approach.

The tools that the engineer uses are the scientific facts at his command. These he must have but they are not the most important attribute of the engineer. Without that intangible thing called "common sense", without creative ability, an engineer will never rise above the status of technician.

The accomplishments of the engineer have resulted more from his attitude toward his work and toward life than from his technical skill. The engineer may take joy in and be justly proud of his ability to conceive and construct a bridge, a dam, a building or a complicated machine but he is also keenly aware that it is only as these structures add to the well being of man that they have value.

With this brief definition of engineering, let us now turn to the development of traffic engineering and see how it differs from other branches of engineering. Traffic engineering may be defined as the application of science to the operation of traffic and to the planning and geometric design of streets and highways.

Historically traffic engineering is the latest phase of highway engineering. Roads go back to the dawn of history. Roads and empires are coeval. When the Roman empire broke up roads fell into decay. In Rome, there was a close parallel to modern traffic conditions in our large cities. Rome legislators raised their voices in protest against the enormous numbers of cars hindering the circulation of the people in the streets of Rome. As early as 214 B.C. the Appian law forbade women to use the two-wheeled and the four-wheeled cars in Rome and other towns except in the case of sacrificial rites. But the women of that day were independent and the law had to be repealed. Other laws were put into effect regulating the proportions to be observed by wheel makers and body builders. The modern railway gauge is said to equal the wheel gauge set by the Romans. But all this passed with the passing of the Empire. It was centuries later before road building was recognized as a necessity. John Smeaton, contemporary of James Watt, the inventor of the steam engine, was looked down upon for undertaking road work as being beneath his dignity and skill as an engineer. It was not until Telford and Macadam revolutionized ideas of road building that it became recognized as engineering.

It is interesting that in the 1820's it was thought that steam carriages would be the main means of transport. But vested interests in teamsters unions and toll roads helped the railroads to win out, and it was not until the 1890's that the internal combustion engine ushered in the age of the motor car. Now roads constitute the main arteries of travel in the United States and no doubt in all countries. It is in the United States that the ever increasing number of motor cars have focused attention upon traffic engineering. When it is estimated that one-seventh of our national effort goes into highway transport, it is not necessary to argue that traffic engineering in contrast to the time of Smeaton is worthy of all the skill the traffic engineer can bring to bear on the problems involved. Let us now examine the nature of traffic engineering.

To most laymen, all engineering is an exact science performed according to definite mechanical laws and rigid mathematical formulas. The engineer's tables and equations are thought of as evidence of unfailing laws that always lead to the correct answer. But the tools of the engineer are not infallible and his is not an exact science. It is to the credit of the engineer that it is his good judgment that so often does lead to the correct answer. If engineering in general

is not an exact mathematical science, then traffic engineering is the least exact of all the branches of engineering for it deals not only with the behavior of materials and forces, but of human beings, whose actions are far more unpredictable.

The engineer has always been interested in the forces of nature rather than in the nature of man. But the motor car is not a complete mechanism until the driver is behind the wheel. It is the driver who sees the curve ahead and turns the wheel accordingly, who senses the roughness of the road and lessens the pressure of his foot on the accelerator, who hears the siren and brings the brake into action. The engineer, while he realizes that drivers like himself are thinking individuals, knows that they are often guided in their actions by emotions which may be quite unstable.

Regarded objectively, highway traffic consists of discrete particles (vehicles) moving in essentially a two-dimensional space. Each particle moves according to the will of the driver, within the limitations set by the power of the engine and by physical barriers, control devices and the presence of other vehicles. Even physical barriers are not wholly effective for the motor car blindly responds to the will of the driver. It will try to leap a brick wall or climb a tree, or run into another vehicle. It doesn't have the horse sense that sometimes brought a drunken driver home in the old days.

Confronted with this most modern of engineering problems, the engineer is building up the science of traffic engineering by using the methods that he has always used. He observes the behavior of traffic, analyzes the collected data and then attempts to find or devise mathematical models which correspond to actual behavior. But in traffic he finds a problem which he must solve in a different way than he is accustomed to.

In building a bridge the design strength of the steel is based upon a very large number of tests. In these tests a range of results has been obtained but the range of manufacturning processes has improved, has been narrowed so that the engineer is confident that the steel will always have a strength equal to or greater than a certain amount. In order that he may be absolutely sure that the bridge will not fail, he applies a factor of safety. From this point on in his design, he uses exact mathematical equations. In traffic engineering, there is often no factor of safety. A highway may be designed to carry 1,000 vehicles per hour but there is no assurance that it will not be jammed to a standstill. The traffic engineer is forced to put aside his exact mathematics and use another approach which is new to most engineers. I refer to that system of mathematics known as statistical methods.

Statistics is not new but goes back to antiquity. It is based on the laws of probability which grew out of a type of mathematics engaged in as a pastime by the Chinese, Greeks and others. Certain of these mathematical series were found to coincide with the chances occurring in card and other types of games. It was not until the 16th century that these laws of chance were put to practical use in figuring actual tables. Since that time, of course, statistics has been put to ever increasing use to such an extent that it is called the "mathematics of human welfare."

The difference between statistics and classical mathematics is that in statistics there is no exact value but a range of variability within which the true value lies. Actually statistics gives the answer as to what assurance there is that the true value lies within certain limits. The engineer may be absolutely sure that no car on the highway will travel less than zero miles per hour or over 200, but he may be only 95 per cent sure that no vehicle will travel over 100 miles per hour.

Statistics is the scientific tool for obtaining facts and determining their accuracy. For example, to determine the coefficient of friction between rubber tires and a pavement a large number of skid marks are measured. In making the measurements certain basic principles are followed. The conditions under which the tests are made must be completely and specifically described so that anyone else can repeat the measurements under exactly the same conditions or with known variations. The results should be concisely but completely reported. To give the average value is not sufficient. What is the range of values? The variations may be more important than the average. The report should be a statistical one.

There are other principles that must be followed. One of these is that provisional conjectures should never be taken as facts. It might be assumed that a level straight-a-way is the safest type of highway and data collected on various types of highways to check the assumption. The engineer should not be surprised if the anticipated result is not true. Again it might be conjectured that since drivers often have to react quickly to avoid accidents, that a quick reacting driver is a safe driver, but actually observations may prove the contrary.

But it not our purpose here to outline the procedure for establishing the scientific basis of traffic engineering but rather to emphasize that established and proven procedures must be followed and that the traffic engineer must learn to deal with large variables. He must also devise new mathematical models that will fit traffic behavior patterns. The limit of application of these models must be clearly defined. A random spacing of vehicles with light, free flowing traffic does not prove that random spacing prevails in congested traffic.

As the traffic engineer learns to use and to adopt statistics to his problems, the science of traffic engineering will become an exact science. When the traffic engineer lays aside his reluctance to deal with anything so unpredictable as human nature, and accepts the fact that he must always be satisfied with a given assurance that a given error will not be exceeded, then he will be able to design our streets and highways and to regulate traffic with scientific accuracy.

23rd Meeting Paper No. 7
Part of Committee Report

Measuring Highway Capacity

By Bruce D. Greenshields (Mem. ITE)

THIS PAPER is concerned with the problem of how to measure highway traffic capacity. In order to discuss the problem, it is first necessary that the term "Highway capacity" be defined, for there is confusion as to what is meant by the term. This is brought out by the Highway Capacity Manual, prepared by the Committee on Highway Capacity, 1950. This manual states that the term which is perhaps most widely misunderstood and improperly used in the field of highway capacity is the word *capacity* itself. In Part I. Definitions, we find that "the term capacity without modification is simply a generic expression pertaining to the ability of a roadway to accommodate traffic". The manual defines three levels of capacity:

1. *Basic Capacity:* "The maximum number of passenger cars that can pass a given point on a lane or roadway during one hour under the most nearly ideal roadway and traffic conditions which can be attained".
2. *Possible Capacity:* "The maximum number of vehicles that can pass a given point on a lane or roadway during one hour under the prevailing roadway and traffic conditions".
3. *Practical Capacity:* "The maximum number of vehicles that can pass a given point on a roadway or in a designated lane during one hour without the traffic density being so great as to arouse unreasonable delay, hazard or traffic conditions".

A more concise definition would certainly be desirable. Speed is implied in the Research Board definition and if possible it should be included. With this in mind, it is proposed that capacity be defined in terms of vehicle miles per hour per mile of lane or roadway. Thus in place of stating that the maximum capacity of a two-lane roadway is 1,550 vehicles per hour, when the average speed is 23 miles per hour, it might be better to multiply the volume (1,550 v.p.h.) by the speed and say that the capacity is 35,650 vehicle miles per hour per mile. But since most people desire to drive faster than 23.0 miles per hour, perhaps 35,650 v.m.p.h is not a practical capacity. Perhaps 35 m.p.h. should be the minimum speed and then it may be found that 31,500 v.m.p.h. is the maximum. In this case the minimum speed would have to be stated for a slower speed might give the same capacity. The point to be emphasized is that capacity should be expressed in terms of volume (vehicles per hour) and speed. One may ask why it is more difficult to measure traffic capacity than say to determine the flow of water through a orifice. The reason lies in the difference in the two things being measured. Water is a fluid that always behaves in the same way under the same conditions. In traffic, no two traffic particles (vehicle plus driver) behave in exactly the same manner. As one observes the movement of traffic the things that affect the flow become apparent. The faster moving vehicles are constantly closing up behind the slower ones and passing them as soon as there is a clear space on the opposite lane. A winding road slows traffic not only because of the drivers reducing speed on curves but also because restricted sight distances keep the faster drivers from passing. If all drivers needed the same distance for passing, or all drivers responded in the same way to winding roads or restricted sight distances the problem of measuring capacity would be greatly simplified. But they do not. Therefore, the traffic engineer must study each variable, express his findings mathematically and then integrate all his findings into a unit of measure for highway capacity. In a sample of 100 or more drivers individual differences tend to cancel out so that the average behavior pattern is close to that of another sample. But the individual differences are important. On the West Side drive in New York City, where there is no place for a disabled vehicle to get off the highway, a single vehicle may slow up traffic for almost the length of the drive. The traffic engineer must be able to estimate about how many of these abnormal drivers there are. He must also be able to estimate the effect of each physical feature on driving conditions. How does the behavior on a nine-foot lane compare with a 12 or 13-foot lane? What effect does a curb have on driving speed? How do the various elements in a traffic stream, trucks, passenger cars, street cars, motorcycles, compare with each other in behavior?

The necessity of accounting for the individual differences of drivers is one that the traffic engineer would avoid if he could. He would like to think of engineering as an exact science even though he knows it is not. In general, the engineer is not too far wrong in considering engineering an exact science. In most cases, he is able to apply a factor of safety and then proceed as if it were an exact science. But in setting up standards for highway capacity, the engineer cannot apply a factor of safety. In designing a highway to carry 1,000 vehicles per hour, he can only estimate the percentage of the time this capacity will be exceeded. He cannot, as in the case of a bridge, design with the assurance that it will never carry in excess of the design loading. The question to answer is how should the engineer proceed when no exact standards can be established.

The answer is that in determining a standard of capacity from sufficient and unbiased field measurements, the results must be reported in a form that shows the variation to be expected together with the corresponding assurance that the result will lie within this variation. This means that statistical methods must be used.

In statistical reporting, the capacity of a two-lane highway for example, would be reported as say 900 vehicles per hour at an average speed of 35 miles per hour with a 90 per cent assurance that the capacity would not vary more than 10 per cent from the average. This kind of reporting should give the engineer more confidence, for he knows the limits of standard he is working with.

In further analysis of the data it may be found that there is an explanation for the behavior pattern. If it is found that there is a good correlation between perception—reaction time and minimum spacing between vehicles, then we may conclude that there is some connection. If this relationship always holds, then we can conclude that mini-

mum spacing can be closely estimated by measuring perception-reaction time.

In studying the spacing between vehicles, it may be found that it is purely random and if this is true, then there is a mathematical model to fit it. The minimum spacing just mentioned may or may not be found to follow a random pattern. In any case, we should find the spacing pattern or patterns and also ascertain how these patterns vary for traffic of different densities.

As we examine the traffic stream, we find that there is a wide variation in speed of vehicles. This stochastic variable must be studied and if possible a mathematical pattern be found for the variations in speed. As faster vehicles constantly overtake slower vehicles, they must find spaces on the opposite lane for passing. The variable time-spacing required for passing must now be studied and if possible a mathematical model found for it.

Having analyzed the spacing, speed, and passing patterns, the next task is to fit these together to form a mathematical model of two-lane highway capacity. Once this is done, it is possible to comprehend and understand and arrive at a design standard for capacity. There is the further problem of determining the effect of each of the different physical features of the roadway on the standards. For example, where the sight distances are restricted, passing is impossible and the capacity is correspondingly reduced.

The four-lane highway presents new variables for the weaving time-distances is different from passing time or distance. The procedure of analysis is the same however. Again it is first a determination of the statistical model for each set of variables and then a fitting together of the separate models.

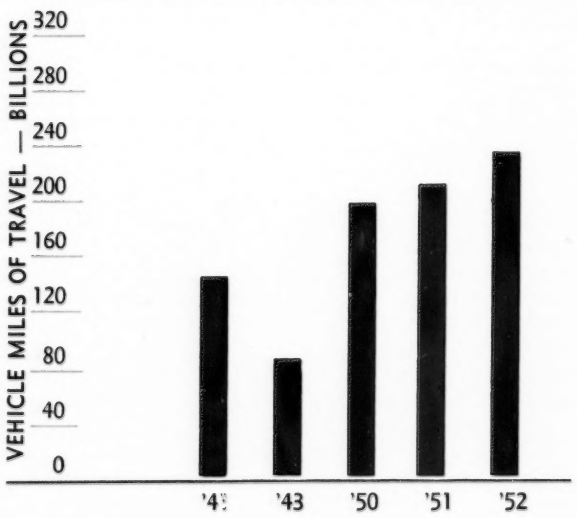
The capacity of street and highway intersections presents a more complicated problem. The behavior patterns are more complex and the control devices, whether traffic signals or stop signs, add new elements. Usually in a problem of such difficulty, it is only after considerable study and several failures that a workable procedure is evolved. The writer after having made a rather extensive study of the problem, suggests a new approach. The arrival times of vehicles at an intersection seem to be reasonably close to a random series. If this can be established within workable limits, then there can be determined from a traffic count, the percentage of time that various traffic units will appear in any given interval in an intersection. A traffic unit means a truck, passenger car, pedestrian, etc. The relative hinderance value of these units can be determined only after careful analysis. The next step is to determine from observations the time it takes a vehicle to traverse the intersection with a given number of units in the intersection.

The number of variables that may enter into a measure of highway capacity points to a difficulty that has not been discussed. This is the difficulty of recording simultaneously all the variables making up traffic behavior patterns. The writer has found time-motion (not motion pictures) pictures the most practical method of recording data. There are many difficulties in this method, but if the pictures are identified by having a counter in each picture then the pictures form a complete record that can be re-analyzed at any time.

Other methods may be evolved that are better than pictures. Any method to be of value must give a complete and accurate record of all the variables that may be important. It is only after study that a variable may be rejected as unimportant.

In this short paper, it has been attempted to point out that the variables in traffic make it impossible to give exact standards for highway capacity. This, however, is not as serious as it may seem, for it is still possible to state the limits of variability of the standards. That is, it is possible to give a statistical answer. It has also been emphasized that techniques of recording the variables must be developed that will yield complete and accurate data.

Traffic Trends



TRAVEL ON RURAL ROADS FOR FIRST TEN MONTHS OF 1941, 1943, 1950, 1951 and 1952

Based on Bureau of Public Roads Data

23rd Meeting Paper No. 8
Part of Committee Report

The Necessity for Appropriate Human Factor Research Techniques in Traffic Engineering

By Theodore W. Forbes (Assoc. Mem. ITE)

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IN THE EARLY YEARS of its development the field of traffic engineering had a pressing need for the development of physical techniques and equipment. Reliable traffic signals, standard signs, durable highway traffic paint, channelization designs and physical separation of traffic all had to be developed.

Now, however, the physical side of these and many other techniques, methods and equipment have been provided or are well on their way to satisfactory development. As these various traffic devices and procedures were put into use in both city and state traffic engineering work, however, it became more and more apparent that the success of the device or technique depended to a large extent upon certain basic human factors. It soon developed that the average motorist did not always see the same thing or do the same thing that the traffic engineer expected him to do when he drew up his design.

This research on human reactions to these various traffic control devices and designs became of great importance, as I believe the majority of traffic engineers now would agree. At first the traffic engineer of necessity learned about the reaction of the average driver on the basis of what happened after his device or design was installed, with sometimes unfortunate results. Later he devised tryout procedures before installing a permanent change, and finally limited studies of problems involving driver reactions were tried by engineering personnel.

However, attempts to obtain design data which were dependent in part on human reaction often proved to be somewhat baffling to the engineer who had little training in physiology, experimental psychology, biological statistics, and other sciences dealing with human behavior. Groups of drivers varied considerably in their use of speed, performance on ramps, and groups of observers differed greatly in the distance at which they claimed to be able to read signs and so on. Different observers might be affected by certain pre-conceived notions about a design or a type of equipment and their observations and reports would be affected thereby.

One of the common tests of scientific reliability is whether or not, under the same conditions, a set of measurements can be repeated with a fair degree of correspondence. This often did not seem to be the case where human factor variables were involved and therefore some engineers have felt in the past that it was not possible to obtain reliable measurements or estimates of such functions.

However, the fields of science dealing with human behavior have developed techniques for handling not only the question of the variability of human reaction but also of exercising experimental control of certain factors which otherwise would invalidate results. Certain of the statistical methods involved have been introduced into traffic engineering practice and have become quite familiar. A good example of this is the use of frequency distributions, 85 or 90 percentile points and indices of variability in connection with passing studies and speed and other studies. Thus it has been recognized that an 85 or 90 percentile speed is a better design figure than an average speed and that for certain purposes these percentile figures are a better index of the reaction of the driving public than the group average. Similarly in before-and-after comparisons of the effect of a design change or a change of regulations, it is important to use a statistical comparison method which takes account of the variability of the observations in terms of the probability that the difference obtained was greater than chance.

In addition to the use of such statistical techniques, it is highly important that methods should be used which will control human factors which would invalidate the results. Such factors are guessing, and the effect of familiarity (in sign studies), and the effects of psychological changes of conditions such as the sight of a uniformed officer. The effect of "expectancy" has been well demonstrated in headlight visibility measurements and so on.

Knowledge of the problem may be one of these factors. It is sometimes possible for experimental observations by trained observers to result in data which can be translated into equivalent reactions of a large unselected population, such as we have driving on our highways. Ordinarily, however, it has been found that too intimate a knowledge of the problem and its components may very easily change the observer's reaction. For this reason it is often important, in order to get competent studies, to use as observers an adequate sample of the ordinary driving population.

This is especially true of opinion studies where interview and questionnaire methods have been used to good advantage for investigating origin, destination, travel habits, and effectiveness of regulations. Here the technique of sampling is very important to insure both an adequate number of cases and the proper composition of the sample in order to obtain a valid answer. Furthermore it is important that the principles which have been painstakingly developed in other fields for the proper design of interviews and questionnaires be used. Unless these are designed and analyzed properly it is quite possible to obtain answers which are not representative of the different views held by different groups of the driving public. Thus again the research techniques of these allied fields are of importance.

(Continued on page 129)

*All opinions expressed are those of the author personally and not of any organization with which he is connected.

23rd Meeting Paper No. 9
Part of Committee Report

The Application of Operations Research to Problems in Traffic Engineering

By Taylor D. Lewis (Mem. ITE)
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PUBLIC RECOGNITION of Traffic Engineering as a profession has been accomplished but its continued development depends on the attitude of practicing traffic engineers. If traffic engineers are willing to strive to improve professional standards, the profession will continue to grow in stature.

Examination of professions closely allied to Traffic Engineering reveals the fact that Operations Research is quite similar. The relative positions of Traffic Engineering and Operations Research, in the general scheme of things, is not definitely determined at present. Some people believe that Traffic Engineering is a form of Operations Research. Regardless of the relationship, practitioners of Traffic Engineering could adopt many of the principles and methodology of Operations Research to considerable advantage.

Operations Research, Operational Research, or the diminutive OPSEARCH, had its beginnings in the military during the last war but has rapidly spread to industry, business, and government. The British Opsearch people had singular success in the solution of radar problems during the "Battle of Britain" and in the solution of anti-submarine problems during the Battle for the Atlantic. Our own military establishment, especially the Navy, utilized Opsearch techniques with profit during World War II. Permanent Operations Research Groups have been set up within and for each of the three branches and on the Dept. of Defense level. (WSEG-Dept. of Def.; ORO-Army; RAND-Air; and OEG-Navy.)

The purpose of pure Opsearch is to provide the person who has power of decision (the executive) with the facts concerning an operation and with a recommendation for action. The persons practicing Opsearch should be research minded and have scientific backgrounds in order that they may provide, first, the true and complete picture of the operation (which at times must be based on fragmentary and incomplete data) and second, recommendation for the improvement of the operation based on the utilization of scientific knowledge or adaptations thereto. Usually the definition of the problem is the most difficult part, once defined the solution usually follows easily. Opsearch is concerned primarily with Research and Analysis so as to provide better operations using the existing tools, men, supplies, machines, etc. There is an overlap into the area of "gadgetry" or Research and Development but major emphasis should remain on operations rather than development.

There are two schools of thought in Opsearch circles, one, which claims that only persons with natural science backgrounds can do Opsearch, and the other, which claims persons with social science backgrounds can also contribute to Opsearch. It seems obvious that operational problems can not be divorced from "Man" as such, therefore, the employment of social scientists seems inevitable.

The Traffic Engineer is naturally interested in how Opsearch Methodology can help him in his work. Some practicing Traffic Engineers will recognize numerous Opsearch methods. In fact, they have been using some for years. However, most of us will admit we have not utilized these aids to their fullest capabilities.

Opsearch regularly uses math models, statistics, and probability with great success. Basic information collecting systems and the extension of meager data can be systematized and materially improved by following Opsearch proven techniques. The average Traffic Engineer does use elementary statistics and occasionally makes use of math models but usually avoids any probability. Those few Traffic Engineers who do habitually employ their college mathematics find that complex problems lend themselves nicely to treatment by this approach.

There are a number of theories which have been developed in recent years which could be as well adapted to Traffic Engineering as they have been to Opsearch. For example, "game theory" and "communication theory" could both be altered to fit every day traffic situations.

Another usual Opsearch technique which could be employed with success by Traffic Engineers is the use of the project group. Experience has proven that an optimum group is from 8 to 15 persons. A group of persons working together can produce much more than the sum of their separate work. Ideas are developed beyond the individual capabilities of the members. A group composed of an optimum number of persons with research and scientific training, but belonging to different disciplines will "spark" one another and will utilize adaptations of scientific knowledge from all their representative fields to great advantage. However, the background material will be gathered better by smaller groups or even individuals.

Traffic Engineers have used to advantage systems of priorities and cost studies. Opsearch also has been able to take advantage of these in what is known as cost/effectiveness ratios. These ratios take the comparison of expenditure results one step further. Greater employment of this tool would assist Traffic Engineers in their problems.

Psychology, Physiology, and Sociology are not strangers to Traffic Engineering as some of their more basic principles have been employed in the solution of traffic problems. However, Traffic Engineering falls far short of Opsearch in the utilization of the knowledge in these fields.

The few methods which have been mentioned are not new, but they simply have been more highly developed by Opsearch than by other professions. The adoption of appropriate Opsearch techniques by Traffic Engineers will not fail to tend to improve professional standards.

23rd Meeting Paper No. 10
Part of Committee Report

Discussion of Committee Report

By Taylor D. Lewis (Mem. ITE)

IT IS DESIRED to state some principles or criteria which can be applied to Traffic Engineering. These are principles by analogy with the "nine principles of war". These are not true principles but are criteria which the traffic engineer can utilize to obtain a proper solution. These principles are:

1. Principle of Priority—The most serious situation gets the first attention.
2. Principles of Proper Direction—Make the right thing to do the easy and natural thing to do.
3. Principle of Cost Effectiveness—The available resources are used so as to get the most value.
4. Principle of Measure—Situations are subjected to measure, not to opinion.
5. Principle of Exposure—Measurements are reduced to rates which truly measure the situation.
6. Principle of Recheck—Every action is subject to periodic review to measure its effectiveness.
7. Principle of Objective—Advance and future planning should be continually revised toward a given goal.
8. Principle of Sales—Have the necessary data and present the data in such a way that there is no argument.
9. Principle of Timeliness—Have the plan ready and available prior to the need.

I believe the definition of traffic engineering published in the magazine "Traffic Engineering" is too narrow. Transportation as a whole is divided into two parts: (1) The design of the facility, and (2) Operation thereof or thereon. Traffic engineering deals with that phase of transportation which has to do with the safe, speedy, and comfortable movement of goods and persons. The traffic engineer is not a "gadgeteer" or a "stop-gap" engineer, but a planner for future need as well as present need. So the Transportation Engineer has on his staff a Traffic Engineer of equal rank to the Design Engineer.

THE NECESSITY FOR APPROPRIATE HUMAN FACTOR RESEARCH TECHNIQUES IN TRAFFIC ENGINEERING

(Continued from page 127)

The Place of Opinions and Opinion Studies in a Technical Handbook

In line with the plea made by President Cherniack a year ago for greater development of the scientific basis of traffic engineering, it seems that the technical engineering handbook in the field should include, as far as possible, basic scientific data. In some cases this has not been developed and the best data obtained by studies which summarize practical experience may have to be substituted and so labeled. Undoubtedly also there is a place for accounts of methods which have succeeded or are preferred in certain cities and states, but it would seem that these should be published in the technical journals rather than in the technical scientific handbook.

Wherever problems involving the human factors are concerned, the data in such a handbook should be, if possible, those which were obtained by use of the best methods for control and analysis of human variables. Where such experimental data are not available or where the problem is such that it depends upon opinion it may be necessary to include results of studies of opinion of the driving public or of those in the traffic engineering field.

As noted above, there have been developed definite principles and procedures for carrying on adequate studies of opinion and of attitudes of the public. The results of such studies should be quoted wherever possible with an indication of the general type of procedure and adequacy of the study.

In the inclusion of results of either experimental or opinion studies, it would seem desirable to have not only the latest such study (or any single study) but, if possible, evidence from several studies which corroborate each other. In case of conflicting results, it is often possible by competent analysis to show that certain differences in the experimental or observational situation were responsible for the discrepancy. If not, it may be desirable to note that further verification is necessary.

In at least one case in the past, a sheer guess on a human ability factor was made in connection with some early studies. This has continued in the technical literature and even in the Handbook of Traffic Engineering in the face of all experimental evidence to the contrary. Inclusion of such a guess would seem to be highly undesirable in a technical handbook even though the original guess may have been highly desirable at the time it was made.

It is recognized that in certain fields like that of administrative procedure it is often difficult to measure effects, or the results of studies may not yet be available. It may therefore be necessary to evaluate different procedures by using the opinion of experts.

If so, two alternatives would seem to be available: (1) To carry out an actual opinion study among a representative group of such experts and to state the basis of the study and the results, or (2) to include a statement by the author as to what he feels to be satisfactory. The former would seem to be preferable and the latter to be highly questionable in any kind of a scientific or technical engineering handbook. If the latter is done, it would seem that it should be definitely labeled as the author's opinion in the absence of other information or evidence.

For example, wherever a statement to the effect that "the preferred procedure is thus and so" is made, we contend that this statement should be substantiated by references to adequate studies of procedure preferences not only in one part of the country but in various different parts of the country. Otherwise such a statement may be misleading and may, in fact, be quite incorrect. By using the techniques mentioned, however, opinion studies may be included on a scientific basis.

23rd Meeting Paper No. 11
Part of Committee Report

Traffic Channelization

By Martin E. Bruening (Mem. ITE)
Traffic Control Engineer, City of Milwaukee, Wisconsin.

Good Traffic Engineering in Milwaukee

THIS IS THE engineering and constructional approach to traffic operations which may be described as:

Traffic Channelization (Definition)

An engineering technique (employing geometric forms) which, by means of various types of traffic island designs, divisional barriers, pavement color contrasts, pavement markings, rotary designs, grade separations, and/or combinations of the foregoing together with traffic control signals, signs, and street lighting, is used to

GUIDE VEHICULAR AND PEDESTRIAN TRAFFIC
For the Purpose of Achieving
SAFETY AND EFFICIENCY
For Both Moving and Standing Traffic

The purpose of channelization is to modify and minimize traffic frictions, and, wherever possible by obtaining additional area to increase the traffic capacity.

To accomplish those purposes, traffic-channelization-designs employ: medial, by pass, mass transit, unused area and rotary islands which serve the various types of traffic channels such as, through, left-turn, right-turn, "U" turn, and parking. Included also are sidewalks and loading areas for mass transit, both of which represent channels for pedestrians.

The entire subject of channelization is approached best by considering first the simplest types of roadway and intersection design. Thus, a "T" or "Y" intersection is the simplest type of intersection, having only three approaches. As such it has *two* basic movements from each approach or a total of (3 x 2) *six* basic movements. When all basic movements are permitted, the result is *three basic conflicts* when there is only one travel lane in each direction.

A tabulation of the basic characteristics of the various types of intersections on the basis of the number of approaches shows:

No. of	Basic-Movements		Basic-Conflicts	
Approaches	No.	Factor	No.	Factor
3	6	1	3	1
4	12	2	16	5⅓
5	20	3⅓	50	16⅔
6	30	5	120	40

(One Travel Lane in Each Direction)

From the foregoing tabulation it is obvious that multi-approach intersections are very undesirable for either safety or control. In some instances, fortunately, not all of the intersecting streets are of high traffic importance. In that case, minor approaches can be designated for one-way operation in a direction away from the intersection. Thus a six-point intersection can be reduced somewhat toward five-point significance as far as basic movements and conflicts are concerned, by simply making one approach one-way leaving the corner. Similarly, a five-approach intersection can become approximately the equivalent of a four-approach intersection; or a six-point location reduced partly to the significance of only a four-approach pattern by designating one-way leaving traffic on two of the minor approaches.

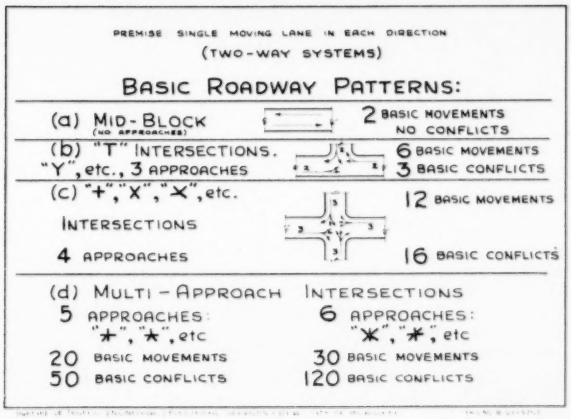


Fig. 1

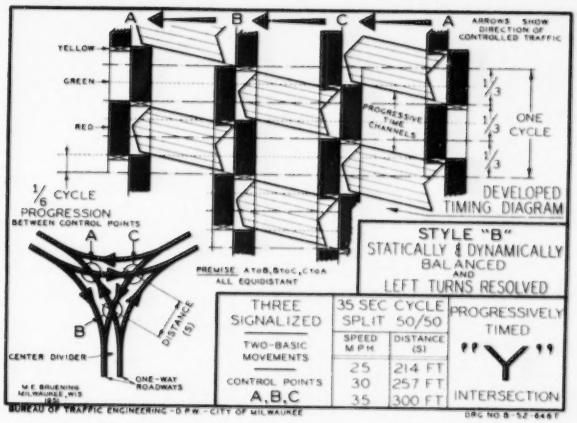


Fig. 3

Particularly in the case of the "T" and "Y" three-approach intersections, is the technique of eliminating one of the basic movements most rewarding. If that is done either by sign control or preferably by the channelization design, then only *one* basic conflict remains. Furthermore, if traffic control signals are operated, then there are *no basic vehiclar conflicts whatever on the* individual phases! Thus the optimum of efficiency and safety of traffic operations is attainable at a three-approach intersection by the simple technique of reducing the six basic movements to five thereby automatically reducing basic conflicts from *three* to *one* and resolving the latter with signal control.

In addition to the *static* characteristics, traffic channelization in the comprehensive sense also has very marked *dynamic* aspects.

Thus, if three "Y" intersections, each having one-basic movement eliminated, were grouped to form one grand "Y" intersection then it will be found that *all* basic movements are present, and what is of particular dynamic significance, the intersection can perform in perfect signal progression on each leg if the proper spacing between crossing points is observed as follows:

(Basis: 35 Second Cycle, Split 50/50)

M.P.H.	Spacing
25	214 Ft.
30	257 Ft.
35	300 Ft.

The above is on the basis of a one-sixth cycle offset between control points and illustrates that the progressive speed rating of such a statically and dynamically balanced intersection is a function of cycle length and control point spacing.

(A similar system on a one-half cycle offset basis is shown on Page 247 of the Traffic Engineering Handbook. Obviously a one-half cycle offset basis requires a larger spacing between control points)

Similarly a four approach intersection, space permitting, could be brought into static and dynamic balance by separating the opposing movements into separate channels, which if sufficiently spaced and equipped with signal operation having a one-fourth cycle offset between control points would produce an intersection with a choice of speeds, depending upon spacing, as follows:

(Basis: 35 Second Cycle, Split 50/50)

M.P.H.	Lateral Spacing Between Opposing Channels
25	321 Ft.
30	385 Ft.
35	449 Ft.

Thus traffic channelization in the comprehensive sense, is a far reaching technique which contemplates the most efficient engineering of the entire roadway pattern in the region and supplies the best possible characteristics, both static and dynamic.

In the localized sense traffic channelization improves a

(Continued on page 135)

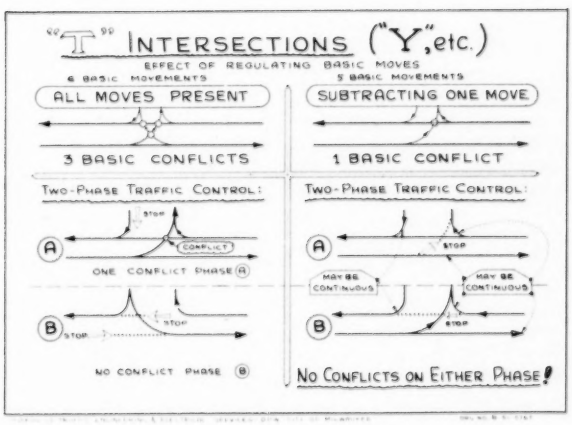


Fig. 2

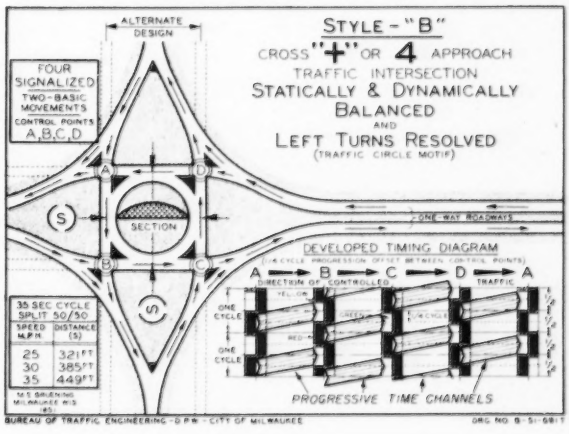


Fig. 4

23rd Meeting Paper No. 12
Part of Committee Report

Traffic Control Signals

By Martin E. Bruening (Mem. ITE)

IN GENERAL traffic signal operations are distinguished in two major groupings consisting of fixed-time and traffic-actuated. In each group there are numerous variations and applications.

In the first group, however, of fixed-time operation it would be well to make a further sharp division into two classes and to emphasize and clearly illustrate the characteristics of,

A. *Uniform Spacing Between Signals*
(A conception of an ideal arrangement of a precisely regular and equally spaced street pattern.)

B. *Irregular Spacing Between Signals*
(The commonly encountered experience with the typical urban roadway arrangement.)

In both groups the chief consideration is to attain the best possible dynamic characteristics or in other words progressive traffic movement between signalized intersections.

A. Uniform Spacing Between Signals

Traffic engineers know and understand that progressive movement at a uniform rate of speed would readily be possible in one direction only on a two-way thorofare regardless of spacing between signals. They also know that a very chaotic speed condition exists at the same time (in most instances) for vehicles moving in the opposite direction. While this is very common knowledge for traffic engineers, it is not so commonly understood by everyone else.

It should also be realized that there is a point at which the matter resolves itself satisfactorily for both directions at once, if it is understood that certain inexorable mathematical requirements must be met before signal systems can have uniform speed characteristics in *both* directions, and even more so if area-wide-grid-type of uniform speed characteristics are desired.

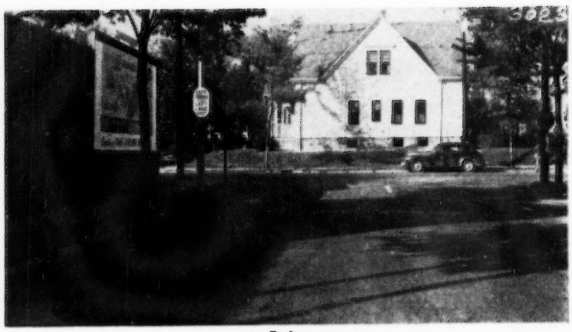
In its basic aspects the entire matter is mathematically akin to the subject of multiples or harmonics. Thus it can readily be determined that with a one-half cycle offset between signal installations there will be produced with the following choices of spacing and cycle lengths the speeds shown in the following table:

(Two-Way Streets)

Grid Spacing	50 Secs.	60 Secs.	70 Secs.	80 Secs.
916 Ft.	25 MPH	20.8 MPH	17.9 MPH	15.6 MPH
1100 Ft.	30 MPH	25.0 MPH	21.4 MPH	18.8 MPH
1320 Ft. (¼ mile)	36 MPH	30.0 MPH	25.7 MPH	22.5 MPH

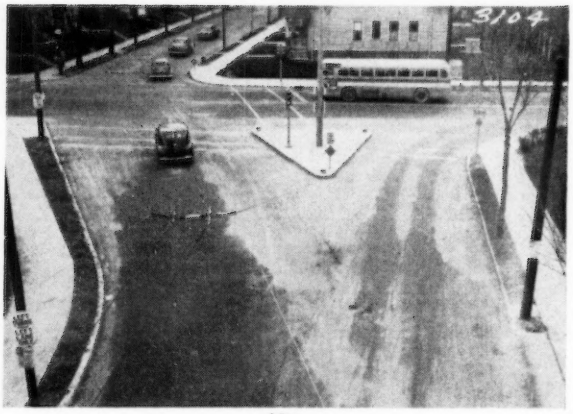
The foregoing points the way toward what should be considered in determining the proper length of a "Superblock" in new city design. It should also be significantly understood that a shorter spacing than those specified is in each case disastrous to progressive movement.

While perfect uniform signal spacing will no doubt be only partially realized at any time, there are sections of cities where it may be possible to confine signal installations more nearly to ¼ mile spacing if the matter is properly understood.



Before

During Construction



After

Fig. 6
Channelization and Signals in Milwaukee.

The foregoing tabulation illustrates the requirements with typical two-way traffic operation on the thorofares concerned. If an area-wide *one-way* grid system were devised on the same basis the offset requirements would be one-fourth cycle between intersections and the spacing requirements would be cut in half as follows:

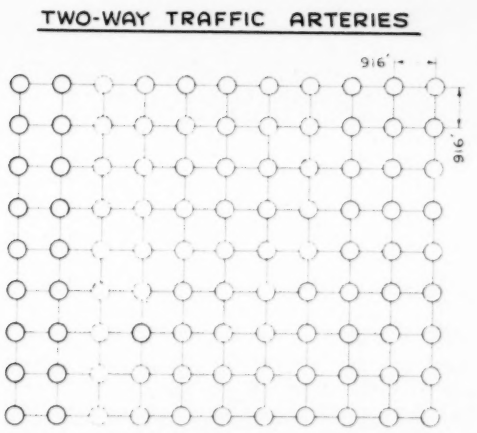

TWO-WAY TRAFFIC ARTERIES
916'
916'
20.8 M.P.H. PROGRESSION -- 60 SECOND CYCLE
OR 25.0 M.P.H. PROGRESSION -- 50 SECOND CYCLE
916 FT. BETWEEN TRAFFIC SIGNALS
AND 1/2 CYCLE OFFSET IN EACH DIRECTION
NOTE: THIS IS TO SCALE ON DRG NO R-48-523T (1500 FT = 1 INCH)
UNIFORM SIGNAL SPACING REQUIREMENTS
TO ACCOMPLISH:
EXACT SPEED SETTING IN EACH DIRECTION
(POPULARLY TERMED "SYNCHRONIZING TRAFFIC LIGHTS")

Fig. 7

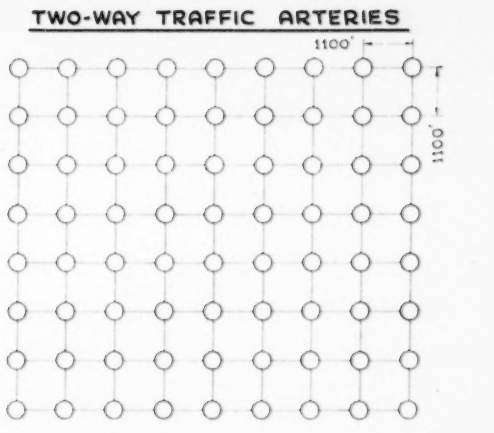

TWO-WAY TRAFFIC ARTERIES
1100'
1100'
21.4 M.P.H. PROGRESSION -- 70 SECOND CYCLE
OR 25.0 M.P.H. PROGRESSION -- 60 SECOND CYCLE
OR 30.0 M.P.H. PROGRESSION -- 50 SECOND CYCLE
1100 FT. BETWEEN TRAFFIC SIGNALS
AND 1/2 CYCLE OFFSET IN EACH DIRECTION
NOTE: THIS IS TO SCALE ON DRG NO R-48-523T (1500 FT = 1 INCH)
UNIFORM SIGNAL SPACING REQUIREMENTS
TO ACCOMPLISH:
EXACT SPEED SETTING IN EACH DIRECTION
(POPULARLY TERMED "SYNCHRONIZING TRAFFIC LIGHTS")

Fig. 8

(Area-Wide, One-Way Operation)

Grid Spacing	50 Secs.	60 Secs.	70 Secs.	80 Secs.
458 Ft.	25 MPH	20.8 MPH	17.9 MPH	15.6 MPH
550 Ft.	30 MPH	25.0 MPH	21.4 MPH	18.8 MPH
660 Ft. (⅛ mile)	36 MPH	30.0 MPH	25.7 MPH	22.5 MPH

If according to the foregoing, a two scale grid-spacing diagram is prepared on a transparency and superimposed on a typical urban map of the same scale showing signalized intersections, only few instances of coincidence will appear. The great prevalence of short spacing between signals will usually become quite apparent. This is another indication that the long cycle simultaneous system is necessarily the best choice of operating under many such circumstances, especially where heavy traffic volumes so overload the artery in question that double-alternate operation is very unsuccessful.

B. Irregular Spacing Between Signals

With non-uniform signal spacing the primary objective is to determine the exact combination of cycle length and offsets which produces the optimum progressive time channel and capacity arrangement for a given set of irregular signal spacings. That determination is best made by following the technique developed by Mr. Douglas A. Bowers and Associates and which is detailed in the Traffic Engineering Handbook on pages 231 to 241 inclusive. With this technique it is possible to pin-point the optimum compromise as well as determining whether several optimum settings are possible.

Traffic-Actuated Control

The adverse effects of irregularities of signal spacing can also be modified by traffic-actuated operation. Those controls also enhance efficiency of operation where traffic volumes fluctuate. Efficiencies cannot be as great where pedestrian requirements require longer intervals.

Another variation of traffic-actuated control is the combination of fixed-time control and detectors which rests in the main-street green position unless actuated by pedestrian or vehicle operation of the detectors. This is quite suitable at generally isolated intersections having high traffic volumes on the artery and low traffic demand on the cross-street.

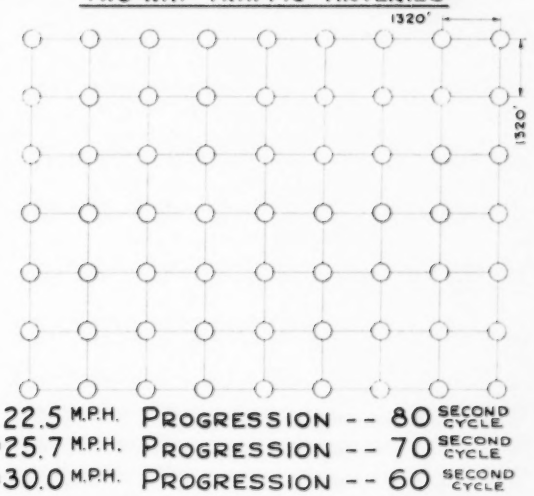

TWO-WAY TRAFFIC ARTERIES
1320'
1320'
22.5 M.P.H. PROGRESSION -- 80 SECOND CYCLE
OR 25.7 M.P.H. PROGRESSION -- 70 SECOND CYCLE
OR 30.0 M.P.H. PROGRESSION -- 60 SECOND CYCLE
1320 FT. BETWEEN TRAFFIC SIGNALS
(¼ MILE) AND 1/2 CYCLE OFFSET IN EACH DIRECTION
NOTE: THIS IS TO SCALE ON DRG NO R-48-523T (1500 FT = 1 INCH)
UNIFORM SIGNAL SPACING REQUIREMENTS
TO ACCOMPLISH:
EXACT SPEED SETTING IN EACH DIRECTION
(POPULARLY TERMED "SYNCHRONIZING TRAFFIC LIGHTS")

Fig. 9

(Continued on page 136)

23rd Meeting Paper No. 13
Part of Committee Report

Traffic Signs for an Express Highway

By Edmund R. Ricker (Mem. ITE)
Traffic Engineer, New Jersey Turnpike Authority, Trenton, N. J.

SIGNS ARE PROBABLY the simplest and most numerous traffic control devices. Their choice and erection appears so simple to the average motorist that the term "sign hanger" has sometimes been used with derision for "traffic engineer". On existing highways, traffic signs are often like crutches, they are employed to overcome physical hazards and provide acceptable operation.

As the control of traffic becomes more complex with higher volumes and speeds, so does proper signing call for increased attention to engineering design. Within recent years the basic knowledge necessary for the proper design of signs has become available, as well as the development of reflective materials to insure their usefulness throughout a twenty-four hour day.

In the construction of a modern express highway, with its own right-of-way, limited access, and high design speed, it is possible to put traffic signs in a different perspective, and to design them as an essential part of the roadway.

This is the case with the New Jersey Turnpike. Realizing the importance of the job to be done, the Turnpike Authority directed that every effort be made to produce the best possible signs. It backed this up with the earmarking of almost a half million dollars to build them. The resulting signs are the product of many persons ideas; the Turnpike Staff, the General Consultant, the General Architect, the New Jersey and other State Highway Departments, the U. S. Bureau of Standards, and many companies who build signs or supply sign materials. Engineering reports were reviewed, field trips made to observe existing signs, drawings made and revised, and experimental signs constructed and tested.

Of the three general categories of signs—warning, regulatory, and informational, the latter seem to be by far the most important on an express highway. When a road is properly designed for high speed traffic, there should be little need for warning Signs, such as a curve symbol or a "SLOW" message; nor for regulatory signs beyond such essentials as the maximum speed limit. These types were included in rare instances, with the thought that they could be added later as the need was proved. The principal emphasis was placed on informational signs associated with the interchanges, in order to assist in the orderly use of the roadway and to take full advantage of the other design features.

The primary purpose of a sign is to put across a message, and the choice of this message becomes the critical element in design, around which all others must take their place. Some of the considerations in the selection of messages are listed below, with comments on the New Jersey Turnpike messages:

1. *Designation of Interchanges.* An express highway does not have many "way stations", and the few points of access must serve rather large areas. Local pride demands that each municipality served must be recognized, but space limitations and simplicity of message do not allow this. Artificial designations, such as serial numbers or letters, intersecting route numbers, names of connecting facilities, or names of immediately adjacent towns or nearby large centers of population all must be considered. On the Turnpike, serial numbers were chosen as the primary designation and emphasized with 30 inch numerals on all important signs. These were backed up in smaller alphabets and on fewer signs with other information to help identify the numeral, such as the "official" names (limited to two municipalities), the intersecting route number, and nearby major traffic facilities (as the Delaware Memorial Bridge).

2. *Advance Warning.* Following closely the pattern which had been used successfully on the Pennsylvania Turnpike, signs were started two miles in advance of each interchange, with the actual point of turnoff being taken as "Zero". The pattern approaching an interchange is shown below:

Distance	Message
2 Miles	EXIT 8 — 2 MILES NEXT EXIT 15 MILES
1 Mile	EXIT 8 — 1 MILE (Official Name)
¾ Mile	EXIT 8 — FOR (Special areas served such as Shore Points)
½ Mile	(Official Name) NEXT RIGHT
¼ Mile — beginning of deceleration lane	EXIT **8** KEEP RIGHT (with arrow)
At point of turnoff	EXIT (with arrow)

The last message deserves special comment; in that it leaves only one choice. If the preceding signs have done their job, no further message is needed; if they have not, motorists should not be encouraged to make last-minute decisions.

3. *Directional Signs.* On toll highways, it is desirable, in order to minimize collection facilities, to funnel all movements through a single plaza. This starts with a large sign at the turnoff from the intersecting highway, with a designation such as "Turnpike Entrance", as opposed to specific destinations. Beyond the plaza there must be a separation of the traffic bound for opposite compass points, and here is one of the most important signs. The message used on the Turnpike is divided in two halves, with appropriate arrows and messages like "New York and North" — "Trenton and

South". On the Turnpike itself, directional information is supplied by: (1) A sign indicating the number of the next exit and the distance thereto, located just beyond the acceleration lane; (2) Signs at 10 mile intervals, indicating the next large city and the distance thereto; and (3) "pull through" signs indicating the next large city and located just beyond each point of exit, but not near enough to distract exiting drivers.

4. *Service Area Signs.* On a limited access highway, particular attention must be given to the provision of essential facilities, such as food, gasoline, and toilets, which are so commonplace on most highways as to be taken as a matter of course. On the Turnpike, those facilities are known as "Service Areas", and are given the same treatment as interchanges, for a distance of two miles in advance. Signs of different color, shape, and alphabet are used to distinguish them from interchange signs.

With the above messages agreed upon, the detailed designs were based on the following points, among others:

1. Design speed of 75 miles per hour. This was employed in calculating necessary letter height to provide reading time for messages.

2. Reflectorization of all messages, except for a few signs around interchanges, which were illuminated.

3. Light copy on dark background. In addition to providing equal or better legibility in daytime, this relationship has the added advantage of remaining the same both by day and night, without a period of reversal at dusk. The background colors chosen were dark green for traffic signs and dark gray for service Area signs. The letters were white or silver, depending on the reflectorizing material.

4. Removable copy. This feature is perhaps the most unique of any in the Turnpike signs. The backgrounds are constructed of redwood, which was chosen because of its long life and freedom from shrinkage or warpage. The letters are cut out exactly to size and shape from aluminum, and the reflecting material attached or inserted according to its own properties. Attachment is by means of aluminum screws. This allows almost complete freedom in changing message texts, fine adjustments to improve spacing and appearance, and a high degree of salvage in the event of damage.

5. Wind Load Design. All signs were designed for 100 mile-per-hour wind loads, on the theory that they might be most needed under severe storm conditions. This required oversized posts, and, in most instances, cable and ground anchor supports.

6. Adequate sizes for messages. While "billboards" were avoided, all signs were designed with backgrounds large enough for the desired messages (the largest is 8′x24′), rather than choosing a standard set of panels and crowding or expanding the messages to fit.

7. Distinctive Shapes. Each of the important signs was designed with rounded or sloping edges to give each a recognizable shape, and all signs with a similar message were thus identified.

8. Alphabets. Considerable attention was given to recent studies in New Jersey and California which indicate that lower case letters are more quickly recognizable as they contribute to the shape of words. Lower case letters were thus used for place names. Upper case letters were used for the shorter traffic messages which are much the same in upper or lower case, such as "EXIT". Series "E" letters were used for upper case, and a lower case alphabet was designed which is quite similar to that used in California.

9. Spacing and edge distance. A vertical spacing equal to 0.8 of the average height of adjacent lines was employed. The horizontal spacing of letters was worked out on the basis recommended by T. W. Forbes.

(FOOTNOTE: "A comparison of lower Case and Capital letters for Highway Signs", by T. W. Forbes, Karl Moscowitz, and Glen Morgan, PROCEEDINGS, Highway Research Board, 1950 p. 355.) The edge distance, between the painted border and the nearest letter was taken as 0.8 of the letter height.

The New Jersey Turnpike signs are designed in accordance with the above criteria, with due allowance for personal choices and human failings. On a road which is constantly in the public eye, they have proved to be effective and have been the subject of many favorable comments.

TRAFFIC CHANNELIZATION

(Continued from page 131)

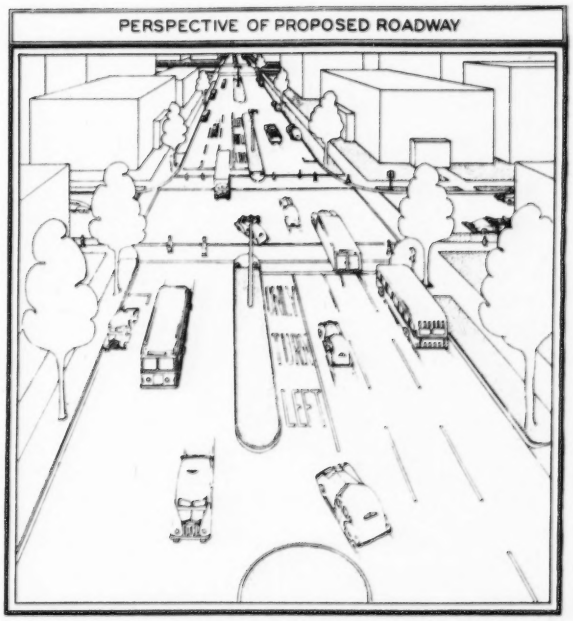


Fig. 5

given location to the greatest degree possible within the limitations of the available space. Every effort is made to organize vehicular traffic and provide turn-out channels for right turns and particularly left turns. Pedestrian safety and convenience is enhanced because the islands are places of refuge particularly when traffic direction changes. Taken altogether, the primary objective is to make the right thing to do the easy and efficient way for both vehicles and pedestrians.

TRAFFIC CONTROL SIGNALS

(Continued from page 133)

Coordination of traffic-actuated equipment renders progressive movement with the advantage of favoring the main artery over cross-streets whenever possible. The more advanced type of Volume-Density controllers enable the attainment of even higher efficiencies at heavily travelled intersections.

Conclusion

Traffic control signals represent the valves which regulate the flow of traffic. Their location, spacing, and method of operation have a great effect on the safety and efficiency with which traffic moves.

As described, however, in most instances they are tied to a roadway pattern which inherently in a great measure violates the requirements of good dynamic characteristics necessary for smooth traffic progression.

Whenever possible, therefore, spacing and functional deficiencies should be modified in the street pattern even if that can only be done at a relatively small number of locations.

With fixed-time signal operation in an urban area, it will ever be true that satisfactory uniform speed characteristics both north-south and east-west are obtainable only if three very basic requirements are observed.

(A) Spacing between signals must be in uniform and identical multiples of distance.

(B) "In-Step" controller equipment capable of proper off-set performance must be used and maintained at top operating efficiency at all times.

(C) There may be no traffic volume overload beyond the "design-capacity" of the artery at any time.

HIGHER STANDARDS IN TRAFFIC ENGINEERING

(Continued from page 122)

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provides instantaneous change of lights without dark periods or overlaps.

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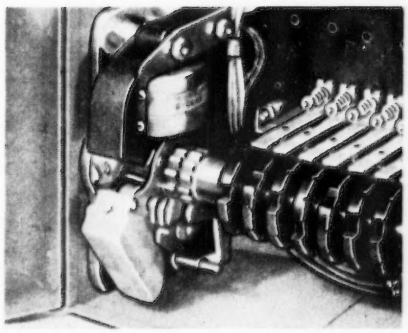
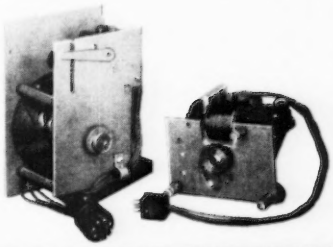
accessible from top, front and back, motor and dial units are jack-connected for quicker, easier maintenance.





Write for Bulletin E10 Today!

THE CONTROLLER WITH THE HIGH 'IQ'

EAGLE SIGNAL CORPORATION *Moline, Illinois*

TRAFFIC NEWS

New Pedestrian Signals Tested in New York

A new type of pedestrian control signal is being tested for the first time when four such devices were placed into operation by the Department of Traffic at 34th Street and Broadway on December 19, 1952, Traffic Commissioner T. T. Wiley recently disclosed.

The signals, flashing "WALK" and "DON'T WALK" signs, are rectangular in shape, measuring 24 inches in width, 12 inches in depth, and 12 inches in height. Each is equipped with four-inch lucite letters which are lighted from behind. The lighting is furnished by seven electric light bulbs of desired colors, stacked in two parabolic reflectors. This arrangement, it is felt, will provide excellent visibility and readability at distances well over 60 feet. The illuminated lucite letters are of Gothic style of a type originally developed for store front advertising. For future installations, however, special block letters will be designed to afford even greater visibility.

One of the features of the experiment is the testing of a variation of signal colors other than the conventional green and red, for added effectiveness. The "WALK" signal will be displayed by a white light, while the "DON'T WALK" will flash in an orange or amber color.

"For some time we have been attempting to develop a pedestrian signal which would overcome the shortcomings of the present types of neon pedestrian signals," Commissioner Wiley stated. "Existing neon signals show the word "WALK" in green, which is appropriate during the "WALK" period, but wrong during the "DON'T WALK" period. If a red neon "WALK" is used, then the color is wrong during the "WALK" period.

"This new type of signal makes it possible to get different colors for the same word at different periods of the cycle. At the beginning of the experiment, the word "WALK" will be shown in white during the "WALK" period and in amber, together with an amber "DON'T" during the "DON'T WALK" period. Different combinations of colors may be tried, as well as different flashing arrangements. Thus, the new signal has much greater flexibility in color schemes and methods of operation and we anticipate it will lead to better control of pedestrians than has been possible with devices previously available."

The signals installed at each of the four corners of this busy intersection will operate in conjunction with the regular traffic signals located there. When the green signal appears for 34th Street crosstown vehicular and pedestrian traffic, the new signals, which will face east and west towards the crosswalks, will display a steady white "WALK" sign.

Twelve seconds before the end of the crosstown green period, the illuminated white "WALK" signal will scintillate at a rapid rate—about 200 flashes per minute. This will indicate to pedestrians that the end of the crossing time is nearing and that they should not leave the curb to cross, or, if having already started, to hurry to complete their crossing. When the red light of the traffic signal appears for cross traffic, the pedestrian signal will display the illuminated orange-amber "DON'T WALK" sign. This will flash on and off at the rate of 60 times per minute.

The new signals were designed by Roy L. Garrish of the Sign Animation Company, and fabricated by the Art Kraft Strauss Company, according to general specifications formulated by the Department of Traffic.

"This new type of pedestrian control signal was designed and constructed in accordance with Department of Traffic specifications by two New York City firms long experienced in sign displays," Traffic Commissioner T. T. Wiley added. "They have been responsible for many of the sign installations that have made Times Square renowned throughout the world for its spectacular lighted displays.

"I believe that the intersection of 34th Street and Broadway—one of the busiest pedestrian crossings in the world —will provide a most effective test of these new signals, particularly at this time, during the peak of the Christmas shopping season. Not only is this crossing, where Broadway and Avenue of the Americas intersect each other, one of the widest pedestrian crossings in the city, measuring over 100 feet in width, but it also is located in the heart of the midtown shopping district, adjacent to some of the city's largest department stores."

Missouri Holds Successful Traffic Engineering Conference

The 116 registrants at the Fifth Annual Missouri Traffic Engineering Conference held November 19 and 20 at the University of Missouri, Columbia, Missouri, pronounced it the most successful ever held in the state. The Conference sponsored by the University, Missouri Highway Department, and other organizations, has been established as an annual event which draws a large attendance of Mayors, City Engineers, Police Chiefs, State Highway Patrol Officers, Highway Engineers, City Traffic Engineers, Consulting Engineers, and other representatives from almost every branch of Government.

The Institute of Traffic Engineers was represented by ITE Director T. M. Matson of Yale University, ITE Vice-President Harry Porter, Jr. of the National Safety Council, and some dozen members of the ITE Missouri Valley Section, which held a Section meeting in conjunction with the Conference.

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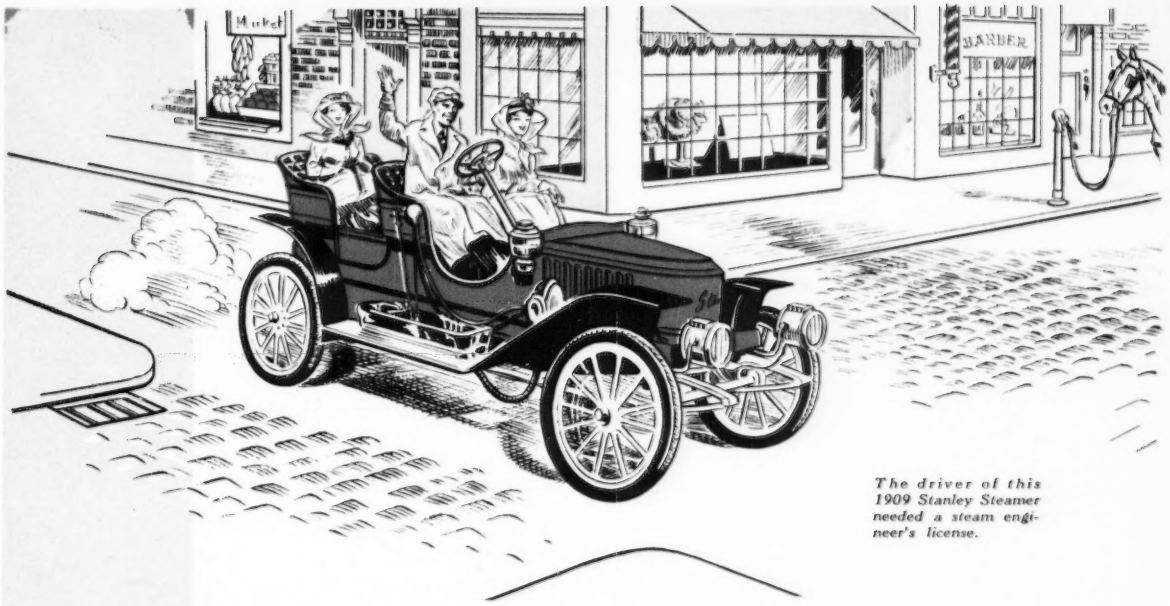

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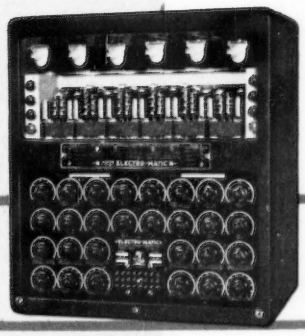

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Fifth California Street And Highway Conference Date Announced

Road men from throughout California will gather at the University of California, Berkeley, February 4-6, 1953, for the Fifth California Street and Highway Conference. Presented annually by the Institute of Transportation and Traffic Engineering and University Extension, University of California, the Conference draws some 500 road men each year for discussion of common problems and new techniques.

Of special interest at this meeting will be a summary of California's highway needs. On the first afternoon, Wednesday, February 4, three men prominently identified with the current scrutiny of highway needs in the State will summarize and interpret some findings of this extensive investigation. These men are Senator Randolph Collier, Carl E. Fritts, and Richard Zettel.

Senator Collier is chairman of the Legislative Joint Fact Finding Committee on Highways, Streets and Bridges; this is the group in charge of the studies. Fritts is vice-president of the Automotive Safety Foundation, which was engaged to gather the engineering data concerning the adequacy of California highways. Zettel is executive secretary of the Fact Finding Committee.

In addition to many state and local men, including Frank Durkee, California Director of Public Works, a number of men prominent in highway and traffic work throughout the country will journey to Berkeley to participate in the program. Included are: Ben H. Petty, af Purdue University; Edward H. Holmes, chief of the Highway Research Board Branch, U. S. Bureau of Public Roads, and Amos Neyhart, of Pennsylvania State College.

Chairman of the Conference is Raymond Archibald, chief of the Western Headquarters, U. S. Bureau of Public Roads. Vice-chairmen are Arthur L. Kiefer, Sacramento County Road Commissioner, and Wayne E. Thompson, city manager of Richmond, California.

NYU Announces New Transportation Engineering Course

New York University will initiate a program of graduate courses in transportation engineering with the academic term beginning in February, 1953, acording to an announcement by Dr. Thorndike Saville, dean of the College of Engineering.

The new program will emphasize modern highway planning, design, and construction; traffic engineering; and airport design. The course offerings are primarily intended for persons holding undergraduate degrees in Civil Engineering. Each course may be taken as a portion of a program leading to an advanced degree, or as a single course by a qualified special student. Completion of the entire series constitutes a measure of specialization in this phase of civil engineering.

Dr. Thomas C. Kavanagh, chairman of the Department of Civil Engineering, stated that the program was being established in recognition of the importance of transportation in modern engineering practice.

"Both public and private agencies have need for men with special training in this field," he explained. "Many large consulting organizations in the New York Metropolitan area are currently engaged in the planning and design of such large-scale improvements as the New York State Thruway, the Garden State Parkway, and the Ohio Turnpike.

"Continuing application of the principles of traffic engineering is necessary for the smoother flow of traffic over existing units of the street and highway system, and for the construction of new facilities designed to relieve traffic congestion.

"Mass transport facilities—railways, subways, buses—play an important role in the life of the city. They depend upon engineering skill for their continued development. The tremendous airport and harbor expansion programs now being undertaken in the New York metropolitan area serve as further examples of the importance of transportation engineering."

The first course in the program, highway planning and design, will be offered in February, 1953. Courses in traffic engineering and airport design will be available in the academic year 1953-54; and courses in bituminous materials and bituminous mixtures, and in advanced transportation engineering, will be given in 1954-55.

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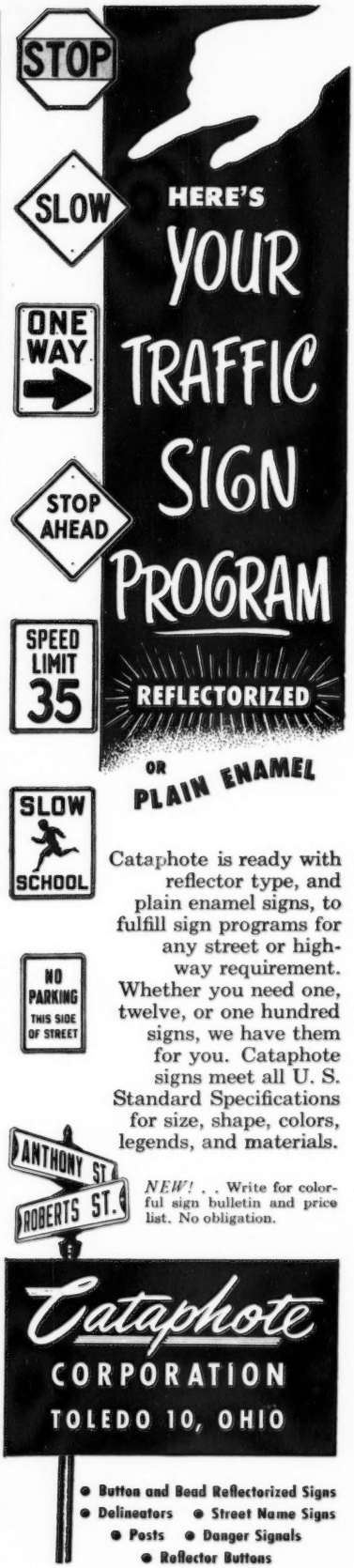
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National Parking Ass'n Announces New Membership Grade And Magazine

The broadening of the scope of National Parking Association membership to include all persons and groups with an interest in parking problems was among the important business actions concluded by the Association at its national convention in Cincinnati in October. The increasing interest evidenced by various individuals and groups such as city officials and traffic and planning committees, merchants, property owners, and many others in the work of the NPA, originally formed as an association of private parking operators, led to the adoption of a resolution at the Cincinnati meeting creating a new associate membership to admit all those concerned directly or indirectly with parking.

In opening up the Association to a wider membership than that of its intended limited trade scope, the members in convention recognized that in order to be of effective assistance in solving the nation's parking problems the Association should include, for action, the city officials, merchants, building owners, and organizations who have a particular concern with those problems.

A sharply increased interest in the work and aims of the National Parking Association was also noted with the publication, shortly before the convention, of the first issue of the Association's journal "Parking".

The recent Cincinnati meeting, the NPA's first regular national convention, marking the birthday of the formation of the group a year earlier at Chicago, was seen as highly successful in that the business conducted, and the enthusiastic attitude of the attending members, prominent city and business officials, and other national groups toward the meeting, firmly established the National Parking Association among the nation's important and influential organizations.

Among the convention activities especial interest was shown in the discussions on a wide range of subjects relating to parking operation and associated influences on it. These covered factual surveys, public transportation, ethical standards, insurance, engineering, leasing and management, validating, among others. These were covered in discussion groups from which reports were made to the convention at large.

In elections held at the Cincinnati convention the attending members re-elected by acclamation President B. M. Stanton of Norfolk, Va., and added a new vice-president, L. B. Doggett, Jr. of Washington, D. C.

The new associate membership created by action of the NPA convention has been made available to non-operators at a lesser fee of $10. The membership will include subscriptions to PARKING Magazine, the Parking News-Letter, and other pamphlets and literature disseminating information from the Association's data files, the most complete central source of parking information in existence.

PARKING Magazine, which has been enthusiastically received by parking operators over the entire country, and others interested in parking, has among its editorial objects assistance in improving off-street parking operation, and improvement of service to the public, by showing operators what is being done in other cities and in providing a medium for exchange of ideas on operation. It will stress the operator's responsibility to the public in service and in providing new parking facilities.

The headquarters of the NPA, which have been located at Norfolk, Va., since the beginning of the Association, have been moved to Washington, D. C.

Lost—6,277 Miles of American Highway

America "lost" more than 6,000 miles of highway in 1951.

A study recently completed by the National Highway Users Conference discloses that a total of 6,277 additional miles of urgently-needed highways could have been built if twenty-six states had not diverted part of their highway user revenues to non-highway purposes last year.

Based upon data contained in reports of the Bureau of Public Roads, the study discloses further that the total number of miles "lost" through diversion practices since 1934 now stands at 121,487 —a figure which is greater than the total road mileage of any single state with the exception of Illinois, Kansas and Texas.

Individually, the number of "lost miles" in the states is dependent upon the average capital outlay per mile of road built, and varies according to the type of construction. These costs ranged from a low of slightly more than $7,000 a mile in Alabama to more than $200,000 a mile in California, New York and Rhode Island.

Individual state figures may be secured from NHUC upon request.

AASHO Has Film Library

Establishment of a library of motion picture films on highway subjects, as a new service to member departments and engineering schools, has been announced by the American Association of State Highway Officials. The films may be obtained on loan through the general office of the association, 917 National Press Building, Washington, D. C.

LOOKING AHEAD

FEBRUARY 9-11, 1953—BOSTON, MASS.
50th Annual Meeting, American Road Builders Association, Hotel Statler.

MARCH 1-3, 1953—ATLANTA, GEORGIA
Annual Meeting, Southern Safety Conference and Exposition, Hotel Atlanta Biltmore.

JUNE 29-JULY 3, 1953—ATLANTIC CITY, N. J.
Summer General Meeting, American Institute of Electrical Engineers.

AUGUST 10-12, 1953—LOS ANGELES, CALIF.
Annual Meeting, American Transit Association, Hotel Biltmore.

SEPTEMBER 14-18, 1953—NEW YORK CITY
Annual Meeting, Illuminating Engineering Society, Hotel Commodore.

SEPTEMBER 28-OCTOBER 1, 1953—BUFFALO, N. Y.
24th Annual Meeting, Institute of Traffic Engineers, Hotel Statler.

OCTOBER 5-8, 1953—COLUMBUS, OHIO
58th Annual Meeting, International Municipal Signal Association, The Neil House.

ITE Calendar

24th ANNUAL MEETING

Hotel Statler
Buffalo, N. Y.

Sept. 27 - Oct. 1, 1953

25th ANNUAL MEETING

Kansas City, Missouri
September, 1954

NORTH CAROLINA says a full-color Welcome with "SCOTCHLITE" BRAND REFLECTIVE SHEETING

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STATE ENTRANCE SIGNS like this reflect a warm, friendly welcome to all who enter the state. They proclaim by their unmatched, radiant beauty the progressiveness and hospitality of the State Administration officials.

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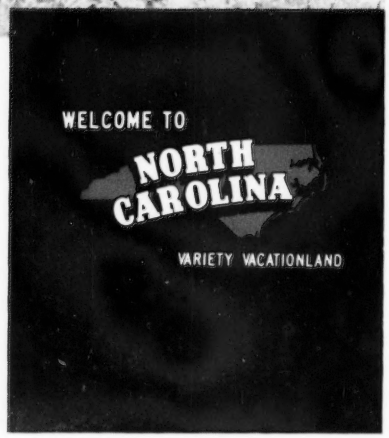

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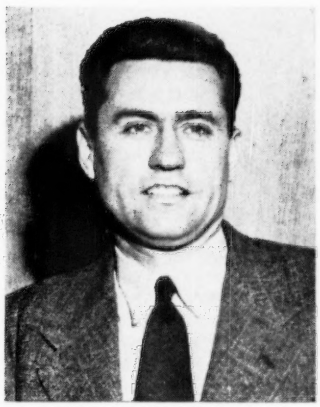
New Appointments . . .

Mills Is Virginia Traffic & Planning Engineer

John Pardon Mills, Jr. (Assoc. Mem., ITE) has been appointed Traffic and Planning Engineer to head the Virginia Department of Highways Division of Traffic and Planning. He succeeds K. G. McWane, who resigned last fall to join the Highway Research Board staff.



John Pardon Mills, Jr.

Born in 1911 in Binghamton, New York, Mills was moved at an early age to Princess Anne County, Virginia, by his parents, where he was graduated from high school in 1929. He attended William and Mary College for two years, then transferred to Virginia Polytechnic Institute from which he received his degree in Civil Engineering in 1936. During his college years he earned letters in basketball, football and baseball. He has continued his interest in sports and for the past 10 years has served as the PA system announcer for most of the football games played at the Richmond City stadium.

Upon graduation he was employed by the Virginia Highway Department which was then organizing its first Statewide Highway Planning Survey to which he was assigned as Chief of a Loadometer Party. Working his way up through the various grades of the Planning Survey and its successor organization, the present day Division of Traffic and Planning, Mills became an Associate Traffic Engineer in 1943 in charge of all rural counts, O & D studies, vehicle weighing activities and other special traffic surveys. In May of 1952 he was promoted to Assistant Traffic and Planning Engineer when that position was first established.

He is active in the Presbyterian Church and by his own admission his chief hobby is assisting Mrs. Mills—the former Lena Reaves of Winter Garden, Florida—in the rearing of their two sons ages 9 and 13.

Martin Becomes City-County Traffic Engineer

The appointment of David B. Martin (Jr. Mem., ITE) as Traffic Engineer for the City of Savannah and Chatham County, Georgia, effective January 1, 1953, was announced recently. This is the first such appointment for either of these separate political subdivisions whose mutual and contiguous traffic problems have resulted in the creation of the new and unique combination traffic engineering organization.

David B. Martin

He was born in 1925 in New Orleans where he has lived all of his life except for one and a half years as a commissioned officer in the U. S. Navy, and nine months at the Yale Bureau of Highway Traffic in 1948-49.

Martin entered Tulane University in 1942. His college work was interrupted in 1945 by his naval service. Following his graduation by Tulane in 1947 with a degree in Electrical Engineering he was employed by the City of New Orleans as Assistant Traffic Engineer in which position he has continued until his new appointment.

He is a member of the American Public Works Association and is a registered professional engineer in the State of Louisiana.

SECTION NEWS

Indiana Section

At a regular meeting of the Indiana Section of the ITE held in Room 410 of the State Library Building, Indianapolis, Indiana, on December 12, 1952, at 10:30 A.M., President John Bunch in the chair and Jim Neff as Secretary, the minutes of the previous meeting were read and approved.

A discussion of the use of portable signals and former objections to advertising of unapproved controls in Traffic Engineering magazine was taken up as a matter of unfinished business. Mr. Milner moved the adoption of a resolution objecting to the use of the advertising in question to be forwarded to the ITE Headquarters for consideration of the Board of Direction which was accepted by all members present.

As a matter of new business, the application of B. H. McDaniel, Assistant Traffic Engineer, City of Evansville, for affiliate membership in the Indiana Section of the ITE was voted on and accepted by all members present.

The above action brought out the need for a membership committee and President John Bunch appointed George Groves to act as chairman and to be assisted by Elmo Stuckey and George Young.

A committee for Purdue Road School program was established by naming George Young chairman and all members present were advised that their help in securing speakers was expected. Mr. Young is to name other members of his committee at a later date.

The problem of securing a name speaker for the General Program at Purdue Road School was raised and anyone having any suggestions was asked to advise the Secretary so that he and the President would be prepared when asked by Professor Ben Petty of Purdue for suggested speakers.

Traffic Engineering questions to be asked on examination for registration for Professional Engineers in the State of Indiana are to be completed for discussion and approval. They are to be presented by President John Bunch at our next meeting.

A bill prepared for the last legislature but never introduced on the use of Traffic Engineers in cities was brought out and discussed along with ways and means of presenting it to the next legislature. This bill having been prepared by the former Indiana Traffic Engineers

Association was accepted by members present on a motion by Mr. Hardy and present ITE officers are to present it to the next legislature.

A committee to work out the details on presentation of the bill was named as follows: James White, Chairman; John Camardy, William H. Bilby and George Groves.

A letter from ITE membership committee setting a quota of ten (10) new members for the Indiana Section was discussed at length and it was recommended that all present affiliate members, who are eligible, should make application for membership in the Institute of Traffic Engineers.

The date of the annual meeting is to coincide with the Purdue Road School and will be held in the Union Building on the Purdue University campus at Lafayette, Indiana.

A motion to retain a room at the Fowler Hotel during Road School for Headquarters of the Indiana Section of ITE was made by George Groves and carried.

After a recess for lunch, President John Bunch gave a colored slide illustrated talk on his recent trip to Germany as an employee of HICOG. The pictures were interesting and gave us all a better idea of conditions in Germany today. Mr. Bunch has over 600 colored slides taken in many locations that are not accessible to most tourists.

Edward G. Wetzel of the New York Section of ITE was present for part of the meeting and everyone enjoyed his visit. The meeting was adjourned at 4:00 P.M.

Reported by James B. Neff
Secretary

Michigan Section

The Michigan Section held a joint meeting with the Engineering Society of Detroit on November 20, 1952 at the Rackham Memorial Building in Detroit. Approximately 120 people attended the dinner at 6:30 P.M. where the speakers, officers, and distinguished guests were introduced. After dinner the meeting adjourned to the main auditorium where a technical traffic program was presented. A count of heads in the auditorium showed that there were about 190 people in attendance for this portion of the program.

Professor Earnest Boyce, Head of the Civil Engineering Department at the University of Michigan, presided as moderator for the panel type program. The speakers panel consisted of A. F. Malo, Director of the Department of Streets and Traffic; J. D. McGillis, Director of the Municipal Parking Authority; Glenn C. Richards, Expressway Co-Ordinator with the Department of Public Works, and Lt. William Polkinghorn, Head of the Parking Enforcement Bureau of the Detroit Police Department. Each of these gentlemen gave a short resume of problems and activities in their respective fields insofar as these effect Detroit traffic at the present time and in the years to come. The discussion panel consisted of Edward Connor, a member of Detroit's Common Council; Jack Kramer, Superintendent of Transportation and Planning with the Department of Street Railways; Bayard Clark, Assistant Director of Safety with the A.A.A., and Donald Slutz, Managing Director of the Traffic Safety Association. This panel presented various questions to the speakers which envoked considerable discussion on many of the pertinent traffic problems the City of Detroit is faced with.

Prior to the panel program, Charles M. Ziegler, Michigan State Highway Commissioner, was introduced. He informed the group that progress was being made in the preparation of plans for additional expressway construction in Detroit. He announced that an Origin-Destination Study will be made in the near future to determine the exact location of the future expressways.

The next meeting is scheduled to be in Lansing sometime in January.

Midwest Section

Twenty-four members of the Midwest Section, Institute of Traffic Engineers, met at the Chicago Engineers Club, Tuesday evening, December 9, 1952, for the Annual Meeting.

A committee was appointed by President Marston to open and count the sealed ballots electing the incoming section officers for the year 1953. The committee reported that the slate of officers selected by the Nominating Committee was elected without a dissenting vote. The following officers were elected:

President, Richard G. Fencl; Vice-President, Ralph F. Gross; Secretary-Treasurer, Evan E. Olmstead.

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Section Directors: (3-year term) Howard F. Ilgner, (2-year term) George E. Hagenauer, Jr., 1-year term) Ralph F. Michel.

President Marston introduced the new officers and after a short speech thanking the section members for their efforts in behalf of the section during his administration, turned the meeting over to the new president, Mr. Fencl. Mr. Fencl made appointments to the following standing and special committees of the section: Attendance and Membership Committee, House Committee, Laws Committee, Program Committee, Special Events Committee, Publications Committee. A short discussion of the activities and responsibilities of each committee was held.

Mr. Jolesch, Chairman of the Committee for the Midwest Section Annual Banquet and Ladies Night to be held January 16, 1953, reported on the progress of his committee's activities. The invitations for the banquet have been prepared and were turned over to the Secretary-Treasurer to be mailed.

Reported by E. E. Olmstead
Secretary-Treasurer

New England Section

Thirty-six members and guests assembled in Springfield on December 2nd at Blake's Restaurant. The guest speaker for the evening was Mr. Edgar F. Copell, Commissioner of the Boston Metropolitan District. The program for the evening was arranged by Earle W. Osterhoudt of the Connecticut Highway Department and Wallace Gove, Worcester Traffic Engineer.

Hugh Wynn, President of the Section, reported that a sleet storm in the New Haven area had been responsible for the cancellation of attendance by 11 members from that area.

Mr. Copell reported that he had been asked to speak on three subjects. He began by describing the relationship of the Traffic Engineer in the Massachusetts Highway Department to other department heads. In Massachusetts the Traffic Engineer is responsible for recommendations relative to snow removal, the development of construction programs and maintenance operations as well as the collection of traffic data. The Massachusetts Traffic Engineer has complete authority over the use and installation of all signs, signals and markings in every town and city of the Commonwealth. The stature of Traffic Engineers throughout the country has increased in importance particularly since World War II because progress in the development of highway programs is primarily dependent upon public acceptance of the need for the large financial expenditures involved. It is, therefore necessary for the Traffic Engineer to be ready with data to justify proposed improvements in terms of improved traffic safety, traffic design and public travel economy.

Route #128 around Boston was originally proposed in 1937. Now about a year old, the route built through an area where a highway did not previously exist carries almost double the traffic that was anticipated for it at this time. This route about 26 miles in length serves as a distributor for Routes 1, 3 and 28.

The tremendous development of the Mass. Highway system has been progressing at the rate of $50,000,000 per year for the past three years and work under a third $100,000,000 bond issue will begin in January of 1953.

The Metropolitan District Commission of which Mr. Copell is now Commissioner, was organized in 1894, and began as a sewer district authority. It now comprises a water system, a park system including a zoo, a highway system and a Police force of approximately 385 men. In effect, the Commission carries on the operations similar to that of a modest size city. Participation in the operation of such a Government agency by the Traffic Engineer constitutes a great challenge because the effect of traffic, whether vehicular or pedestrian, is felt in every public service agency.

The famous "Shoppers World" which has been recently built outside of Boston between Route 9 and Route 30 has been based on careful studies of vehicular traffic trends. This large installation located between two primary routes depends to a large extent upon women for trade and yet it has been learned that women prefer to travel over secondary routes when they drive their own cars. The facility provides approximately 6,000 car parking spaces. This capacity represents about 150% of the actual need. However, studies of accumulation of parked vehicles in off-street areas indicate that the 150% design factor is a good rule of thumb for this type of facility. A gross area of approximately 300 square feet per car has been allowed within the area in order to encourage parking with a minimum of effort by potential customers.

It has been decided that two-way traffic operation within the off-street parking area is desirable for psychological reasons alone. In line with this idea, uniformed policemen serve primarily as guides and service aides to people using the facility.

It has been found that trucking docks should be carefully designed to be of adequate but not extraordinary size. The delivery of merchandise to such facilities as "Shoppers World" is essentially a once-a-week affair. Therefore, trucking docks need only be of reasonable capacity to fit delivery schedules. It has been determined that standard street lighting rather than flood lighting is much more effective in such an area.

Investors in the development of such an area have also learned that it must necessarily be a long-term investment. There is a profit obtainable from the investment but it is in proportion due to the skillful traffic planning of the facility.

It was announced that the next meeting of the Section would be held in Hartford during the month of February.

Reported by Earl H. Flynn
Secretary-Treasurer

Washington, D. C. Section

Thirty members and guests attended the December 3 meeting of the Washington Section in the Army and Navy Club in the District of Columbia. Goley Sontheimer, Director, Department of Safety, American Trucking Associations, was the featured speaker of the evening and considerable discussion revolved around the matter of accident frequencies related to vehicle design and operation.

The next meeting is set for January 14 at the time of the Highway Research Board Annual Conference here in Washington and all out of town ITE members are invited to attend. It will begin at 6:00 p.m. at the Army and Navy Club. Edmund R. Ricker, Traffic Engineer of the New Jersey Turnpike Authority will discuss traffic operations on the New Jersey Turnpike. Please get in touch with Henry K. Evans at the U. S. Chamber of Commerce, Secretary of the Section, concerning reservations for the meeting.

Reported by Nathan Avins
Secretary-Treasurer

New York Metropolitan Section

The first meeting of the 1952-1953 fiscal year was held at the Masonic Club at noon December 10. Twenty-six members and guests were present.

Because of difficulties with equipment, the showing of the General

Motors film "Better Highways Awards", could not be held. Mr. Ricker opened a general discussion of the subject of financing better roads and highways, and the modernization of existing roads and highways. The discussion related to the matters of auto tax diversion, and laws to prohibit such diversion; increase in gasoline taxes, and the question of whether any one group of taxpayers, or the general public, should be expected to pay for better roads. It was the consensus of opinion that the question of financing better roads is a matter of educating the public to the economic importance of better roads to all people.

The meeting was adjourned at about 2:45 p.m.

The date of the next meeting will be announced at a later date.

Reported by Nathan Avins
Secretary-Treasurer

Missouri Valley Section

The Missouri Valley Section held a meeting on November 18, 1952 at the Tiger Hotel, Columbia, Missouri, in conjunction with the Fifth Annual Missouri Traffic Engineering Conference which opened at the University the following day.

Vice-President Leon Corder, Missouri State Highway Department, presided in the absence of President George J. Fisher of Wichita. Meeting was called to order at 9:00 P.M., after which distinguished visitors were welcomed and the minutes of the previous meeting were read and approved. Treasurer's Report was also made and accepted as read. Professor Theodore Matson of Yale University, one of the distinguished visitors extended greetings from the New England section, and discussed meetings of his section as well as giving numerous suggestions for the betterment of attendance at our meetings. Another of the distinguished visitors was Mr. Harry Porter, National Safety Council, who extended greetings from Mid-west section, and also extended an invitation for attendance at their Mid-west section meeting to be held January 16th in Chicago, Illinois. Mr. Lawrence Kane, another Institute member, a distinguished visitor from the Mid-west section enjoyed the meeting and contributed beverages, as did Institute members Matson and Bierman.

Invitations to join the Section as affiliate members were extended to Mr. Jack Hutter, Assistant Traffic Engineer of Kansas City and Mr. A. J. Basile, Assistant Traffic Control Engineer of the State of Kansas. Both of these invitations were accepted, and the two gentlemen were then inducted as affiliate members of the Missouri Valley Section.

Those in attendance at the meeting in addition to our distinguished visitors were: *"Sir Commander"* Leon Corder, Missouri State Highway Department, Vice-President of the Missouri Valley Section; Thomas J. Seburn, Director of Traffic, Kansas City, Missouri; Mr. Melvin Bierman, City Traffic Engineer of St. Joseph; Mr. Burt Whedon, Traffic Control Engineer of Kansas Highway Commission; Mr. Jack Hutter of Kansas City; Mr. A. J. Basile of Topeka, Kansas; and Joseph J. Feuchter, Traffic Associates Consultant, St. Louis, Missouri. Though present, but unable to attend the meeting itself were members—Reyburn Hoffmann of St. Louis and George C. Lichty, Missouri Highway Department. Past President Tom Seburn reported, in preparing for the 1954 Annual Conference of the Institute of Traffic Engineers, arrangements had been made for holding the headquarters at the Hotel Buehlenbash, with the tentative dates of 26th to the 30th of September.

The Secretary was instructed to inform the proper authorities as to the provisional endorsement of Toll Roads for the area covered by the Missouri Valley Section which had been obtained through balloting of all members.

The meeting of the Missouri Valley Section which was held in conjunction with the Fifth Annual Missouri Traffic Engineering Conference also passed a motion that recommendation be submitted to the University of Missouri that a Sixth Annual Traffic Engineering Conference be held in 1954 along the same lines, and under the same sponsorship as the meeting held at this time.

The Secretary announced his appointment to the "New Members Committee" and his assignment as Sponsor for the Mid-west Section, and announced a goal of 10 which had been given this Section for New Members, and along these lines Mr. Jack Hutter stated that his application would be sent very shortly, and also that of Mr. A. J. Basile. In addition to which, our member Burt Whedon from Kansas, informed the meeting that he would endeavor to have his superior Mr. Ireland, Traffic Engineer of the State of Kansas, to submit his application. Secretary further reported that the Traffic Commissioner of St. Louis, as well as the City Planning Director had been solicited as to membership, and have been favorably received though the applications have not been forwarded.

The Secretary was further instructed to send the names of potential members in the Missouri Valley Section to all members of this Section, with the idea that they would endeavor to secure applications from these individuals for membership in the parent organization.

After numerous quips and jokes by the acting chairman, *"Sir Commander"* Corder and the imbibing of a little refreshment as previously mentioned, being provided by the distinguished visitors Professor Theodore Matson and the Honorable Lawrence A. Kane, as well as the distinguished Traffic Engineer from the (North-west Section,) the Northwestern corner of the State of Missouri Melvin Bierman, the meeting went into a social session which lasted for considerable time, after which all agreed that it was a most enjoyable meeting.

Reported by Joseph J. Feuchter
Secretary-Treasurer

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Secretary's Column

The last issue of the old year (December 30, 1952) of LOOK magazine carried an interesting story, with pictures, on the Merritt Parkway. The story, which was written by J. C. Furnas, is titled "Queen of the Toll Roads" with the catch-line "After 14 years, she is old and crowded and all but obsolete, but the engineers are grateful to a pioneer highway that taught them many valuable lessons in safety". Not mentioned is the fact that while the Parkway operates as a toll road it is not a toll road in the usual sense of the word. Every toll station of which there are only three for both the Merritt and its more modern 50-mile extension, the Wilbur Cross Parkway—can be quite easily bypassed by a three or four-mile trip using a combination of some of the 50 free entrance-exit interchanges and parallel free roads. Even when toll is paid as is the case with 99% of the users, the rate is so nominal—about one-third cent per mile—that the toll income is little more than sufficient to maintain and pay interest on the facility.

But the story is well done and should prove of as interesting to every traffic engineer as it will to most of the 20 million readers of LOOK.

The current January issue of the ever popular "POPULAR MECHANICS" has a two-page spread (pages 156 and 157) on Henry Barnes' pride and joy—the variable cycle selector master-controlled traffic signal system in Denver. Entitled "$100,000 'BRAIN' KEEPS DENVER TRAFFIC ROLLING", the feature includes Hank pictured with part of the master controller, and an artist's drawing of the layout of the 140 block downtown area of Denver indicating the location of the sampling detectors and each of 155 intersections that are controlled.

As editor of TRAFFIC ENGINEERING, I'm continually in need of new articles. The Institute has among its membership a large number of able writers—quite frequently I see articles in other periodicals written by ITE members—and there must be a large number of potential authors who, because of the necessities of daily bread winning, never seem to get around to putting their talents to writing for publication. Let me assure you there are few greater satisfactions than seeing in print an article you've created. And there's no better way of enhancing your professional reputation—and, incidentally, improving your knowledge, ability, and often your financial return—than by preparation of articles that are published.

Every participating traffic engineer has fertile ground as subject matter for interesting articles. This nation of ours is so vast, the traffic problems so numerous and the skills and experiences of our traffic engineers so varying that practically any type of article—from the daily routine investigation and recommendation reports to the all inclusive research project series—will be interesting to some if perhaps not all of TRAFFIC ENGINEERING readers.

So, *please* ITE authors and would-be authors, help make my new year (and your own) more satisfying by whipping that idea of yours into an article to help make our magazine bigger and better.

TIM TODD

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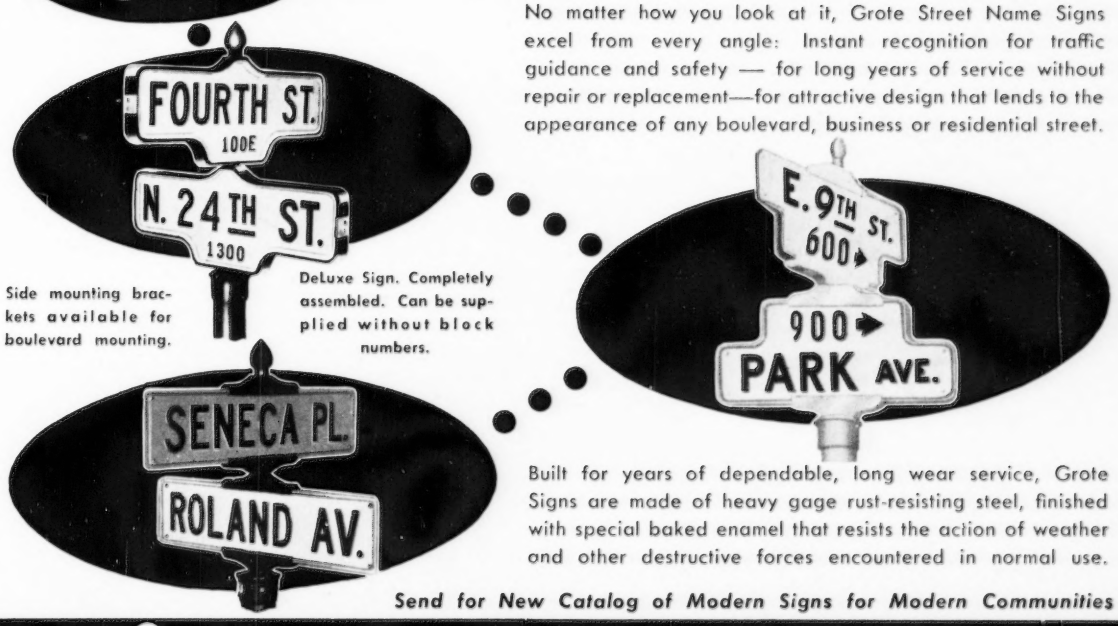

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Letter To Editor

The December issue carried under Traffic News an item "American Highway Engineers Working in Iraq". As commentary on that item, Mr. Kelcey of the firm Edwards, Kelcey and Beck, Newark, New Jersey, submitted the following:

December 23, 1952

Sir:

I note your report in the last issue of TRAFFIC ENGINEERING on the mission of highway engineers we sent to Iraq.

You may be interested in one of the sequels to their trip. When the mission reached Baghdad they found the roads blocked between the airport and town by soldiers and gun crews with a good rifle fire and rat-tat-tat of machine guns over toward town. By phone they made arrangements with their hotel, hired an old arab and rowboat and made their way up the Tigres River and across, where their hotel dropped a ladder out of the second floor on the river side and the men and their wives invaded the city that way. They found a garden party going on in the rear of the hotel, machine guns on the roof and a riot out on the street in front.

Mr. McDonald, head of the mission, reports that things have now quieted down and that the mission is in action on the Iraq highway program.

I have to make two trips a year to Iraq, the first of which will be in a month. Mrs. Kelcey is going with me and refuses to back out, riots or no riots.

Yours cordially,

GUY KELCEY

ON THE SHELF

Compiled by
Mrs. Cele Kagan, Acting Librarian
Yale Bureau of Highway Traffic

Alabama Legislative Council.

Alabama Traffic Safety; A Study of Traffic Safety, Traffic Safety Laws and Their Administration and Enforcement with Recommendations for Changes in Them. The Legislative Reference Service, 1952. 65pp.

A Study of Traffic Safety in Alabama and the state's laws relating to traffic on highways. The report contains factual data relative to the state's traffic safety record and the administration and enforcement of its traffic laws, a comparison of the provisions of Alabama's traffic laws with those of the Uniform Act Regulating Traffic on Highways, and recommendations for changes in Alabama's traffic laws and administrative and enforcement procedures.

Beggs, A. Kenneth

The Railway-Highway Grade Crossing Problem; Economic Principles. Stanford Research Institute, 1952. 55pp.

This report deals with economic aspects of the grade crossing problem. The object of this study is to examine some of the economic principles underlying three aspects of the grade crossing problem, namely:

1. Bases upon which improvements and eliminations may be justified.
2. Guides to the order in which such projects should be undertaken.
3. Distribution of the costs among the various groups receiving benefits.

Boston, Massachusetts. City Planning Board.

Preliminary Report on a General Plan for Boston. The Board, 1951. 63pp.

Contents: Business and Industry; Residence; Schools and Recreation; Transportation.

The Bowser Engineering Company

The Bowser Parking System. The Company, n.d. Des Moines, Iowa. 6pp.

A parking system which pigeonholes cars automatically by elevators.

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